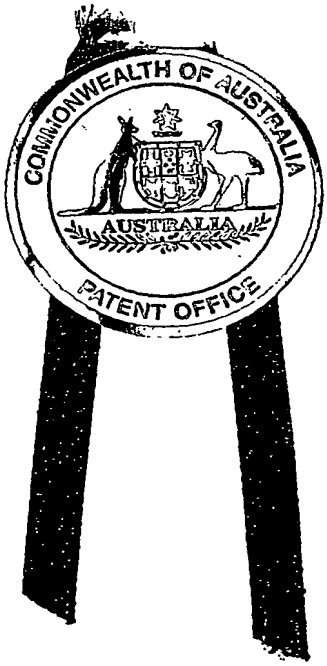
PCT/AU2004/001099

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Patent Office
Canberra

I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003904446 for a patent by RAPID INTELLIGENCE PTY LTD as filed on 19 August 2003.



WITNESS my hand this
Twenty-fifth day of August 2004

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
AND SALES

Our Ref: 7730000

P/00/009
Regulation 3:2

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant(s): Rapid Intelligence Pty Ltd
3/109 Young Street
Cremorne New South Wales 2090
Australia

Address for Service: DAVIES COLLISON CAVE
Patent & Trade Mark Attorneys
Level 10, 10 Barrack Street
SYDNEY NSW 2000

Invention Title: **Content system**

The invention is described in the following statement:

CONTENT SYSTEM

Background of the Invention

The present invention relates to a method and apparatus for controlling the presentation of content instances using a processing system, and in particular, to controlling the presentation of content in accordance with a content network.

Description of the Prior Art

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgement or any form of suggestion that the prior art forms part of the common general knowledge in Australia.

Many methodologies exist for finding relationships between particular items of content, including relationships such as "people who liked/viewed/bought this, also liked/viewed/bought these" type of relationships as provided for example on Amazon.com. Accordingly, relationships of this form allow users to view other content that has been determined as similar to the content currently being viewed.

Currently, relationships such as these are derived using various kinds of statistical analysis of data collected from submitted user recommendations or purchasing information. In particular, this is often achieved by mapping an individual piece of content to another piece of content. As each piece of content is considered independently, there is typically a limit to the usefulness of the relationships.

In particular, this technique doesn't determine the links in accordance with a set of objectives that have been defined for the system, and doesn't examine paths followed by the users, but rather simply creates individual links on a case-by-case basis.

Other personalisation technologies are concerned with mapping content to known user attributes. For example, a user might specify to a women's site that she has had a baby in the past 6 months and is from a high income group. The web site may respond by

providing newsletter content on upmarket baby foods. While user profile based methodologies may be "added on" to this system, they are not required and indeed, the example implementation makes no use of it.

As a result of these issues, a large field of knowledge on artificially intelligent systems where networks of nodes are created, bound together by links has been developed. However, the ability of systems of this form to modify relationships without external user intervention is currently limited. In particular, such system usually require user intervention to configure the system for specific content, and monitor operation of the system to ensure that desired objectives are being met.

Summary of the Present Invention

In a first broad form the present invention provides a method of controlling the presentation of content instances using a processing system, the method including causing the processing system to:

a) Present one or more content instances to the user in accordance with a content network;

b) Determine one or more responses provided by the user in response to the presentation of the content instance;

c) Evaluate the one or more responses in accordance with predetermined criteria; and,

d) Modify the content network in accordance with the results of the evaluation.

Preferably, the predetermined criteria representing predefined objectives, with the method including causing the processing system to evaluate the responses to thereby determine the ability of the one or more presented content instances to satisfy predefined objectives.

Preferably, the method includes repeatedly modifying the content network such that content instances that are determined to be more able to satisfy the predetermined objectives are presented.

Typically the method includes modifying the content network iteratively to thereby optimise the content network such that the ability of the content network to satisfy the predetermined objectives is improved.

The content network generally includes:

a) An indication of a number of presentation instances, each presentation instance being associated with one or more content instances, and each content instance being associated with one or more presentation instances;

b) One or more links for connecting each presentation instance to a subsequent presentation instance; and,

c) A weighting associated with each link.

The method generally includes causing the processing system to modify the content network by modifying the weightings in accordance with the responses.

The method typically includes repeatedly modifying the weightings in accordance with determined responses to thereby modify the weightings of links according to how well they satisfy the predetermined objectives.

The method generally includes causing the processing system to present the content instances by:

a) Presenting one or more of the content instances associated with a respective presentation instance;

b) Selecting a link in accordance with the one or more responses, the link connecting the respective presentation instance to a subsequent presentation instance;

c) Presenting the one or more content instances associated with the subsequent presentation instance; and,

d) Repeating steps (b) and (c) as required.

Generally at least one of the responses includes a request, the method including causing the processing system to select a link in accordance with the request.

In this case, each presentation instance typically includes one or more request options, each request option having one or more links associated therewith, the method including causing the processing system to:

a) Determine the request from the one or more responses;

b) Select a request option corresponding to the request; and,

c) Select one of the links associated with the selected request option.

The method preferably includes causing the processing system to modify the weightings of selected links by:

a) Determining the one or more responses to the presentation of the one or more content instances associated with a respective presentation instance; and,

b) Modifying the weighting of each link selected prior to the content instances being presented in accordance with the determined response

The method generally includes causing the processing system to modify the content network by modifying the links, the modifications including at least one of:

a) Removing a respective link;

b) Creating a new link; and,

c) Moving a link from one presentation instance to another presentation instance.

The method typically includes causing the processing system to compare one or more of the weightings to a predetermined threshold and perform the modification in accordance with the results of the comparison.

The predetermined threshold is preferably determined in accordance with the weighting of other links in the content network.

The method typically including causing the processing system to create a new link if at least one of:

a) The weighting of one or more existing links falls below a lower threshold;

b) A rating of one or more content instances or presentation instances falls below a lower threshold; and,

c) The weighting of one or more existing links is above an upper threshold; and,

d) A rating of one or more content instances or presentation instance is above an upper threshold.

The method generally includes causing the processing system to remove a link if at least one of:

a) The weighting of the link falls below a lower threshold; and,

b) One of the presentation instances to which the link is associated is removed.

The method typically includes causing the processing system to update the content network by:

a) Determining one or more new presentation instances; and,

b) Create one or more links associated with each new presentation instance, the links linking each new presentation instance to one or more existing or other new presentation instances.

The method can include determining the new presentation instances in accordance with ratings associated with each content instance or each presentation instance.

The method can include causing the processing system to:

a) Determine the one or more content instances associated with a respective presentation instance;

b) Select one or more of the content instances; and,

c) Present the one or more selected content instances.

The method may include causing the processing system to:

a) Determine a weighting for each content instance associated with the presentation instance; and,

b) Select one or more content instances associated with the presentation instance in accordance with the determined weighting.

Each presentation instance can have one or more content instance criteria associated therewith, the method including causing the processing system to:

a) Determine the one or more content instance criteria; and,

b) Select one or more content instances in accordance with the content instance criteria.

Typically, one or more of the content instances, the presentation instances or the links including predetermined instructions, the method including causing the processing system to:

a) Determine the instructions; and,

b) Present one or more content instances in accordance with the instructions.

The instructions can include references to one or more content instances, the method including causing the processing system to:

a) Select the one or more content instances in accordance with the instructions; and,

b) Present the one or more content instances.

The method typically includes selecting the one or more content instances in accordance with at least one of:

a) A content instance rating;

b) A content instance weighting;

c) A content instance type, each content instance having an associated type determined in accordance with the nature of content contained therein; and,

d) Descriptive data (structured or unstructured) pertaining to the content instance's relationship to other content instances.

Each content instance, presentation instance, link or content instance combination can have an associated rating, in which case the method typically includes causing the processing system to:

a) Evaluate each response in accordance with the predetermined criteria;

b) Determine a rating modification in accordance with the results of the evaluation; and,

c) Apply the rating modification to the corresponding content instance, presentation instance, link or content instance combination upon which the response is based.

The predetermined criteria can include one or more criteria instances, each criteria instance including an indication of a respective rating modification. In this case, the method can include causing the processing system to:

a) Evaluate each response in accordance with one or more selected criteria instances; and,

b) Determine the associated rating modification in accordance with the results of the evaluation.

Typically, the content instances are stored in a store, with the method including causing the processing system to:

a) Receiving new content instances;

b) Storing the new content instances in the store; and,

c) Amending the content network in accordance with the new content instances.

The method may include causing the processing system to determine from the response at least one of:

a) A rating provided in response to the presentation of the content instance, the rating being provided by the user;

b) An indication of the length of time the user spent observing the content instance; and,

c) An indication of whether the presentation of the content instance to the user caused a predetermined event.

The one or more of the responses may include a request, in which case the method includes causing the processing system to present further content instances in accordance with the determined requests.

The processing system can being coupled to an end station via a communications network, the method including causing the processing system to:

a) Transfer content instance to be presented to the end station via the communications network, the end station being adapted to present the content instance to the user; and,

b) Receive a response generated by the end station via the communications network.

In a second broad form the present invention provides apparatus for controlling the presentation of content instances, the apparatus including a processing system adapted to:

a) Present one or more content instances to the user in accordance with a content network;

b) Determine one or more responses provided by the user;

c) Evaluate the one or more responses in accordance with predetermined criteria; and,

d) Modify the content network in accordance with the results of the evaluation.

The apparatus is preferably adapted to perform the method of the first broad form of the invention.

In a third broad form the present invention provides a computer program product for controlling the presentation of content instances, the computer program product including computer executable code which when executed on a suitable processing system causes the processing system to perform the method of the first broad form of the invention.

Brief Description of the Drawings

An example of the present invention will now be described with reference to the accompanying drawings, in which: -

Figure 1 is a schematic diagram of an example of a processing system for implementing the present invention;

Figure 2 is a flow chart outlining the process implemented by the processing system of Figure 1;

Figure 3 is a schematic diagram of an example of a content network utilised by the processing system of Figure 1;

Figure 4 is a schematic diagram of an example of a system for implementing the present invention;

Figure 5 is a schematic diagram of an example of an end station of Figure 4;

Figures 6A and 6B are a flow chart detailing an example of the process of presenting content to the user using the system of Figure 4; and,

Figures 7A to 7 E are a flow chart detailing an example of the process of modifying the content network using the system of Figure 4.

Detailed Description of the Preferred Embodiments

An example of apparatus suitable for presenting content to a user in accordance with the present invention will now be described with reference to Figure 1.

In particular, as shown the apparatus is formed from a processing system 10 coupled to a data store, such as a database 11, or the like. In use content instances, such as images, text, and multimedia content, are stored in the database 11. Accordingly, the database is typically a relational database, or the like, although any suitable form of data store may be used.

In any event, the processing system 10 is adapted to present content instances to a user. The processing system then rates the user's response and uses this to modify the manner in which the content instances are presented in future. In order to achieve this, the processing system 10 generally includes at least a processor 20, a memory 21, and an I/O device 22, and a port 23 for coupling the processing system to the database 11, each of which are coupled together via a bus 24 as shown. An optional external interface 25 may also be

provided, as will be explained in more detail below.

The I/O device 22, which may be a keyboard and monitor, or the like, allows content instances to be displayed to the user, as well as to receive responses from the user. The database interface allows content to be transferred between the processor and database, as will be described in more detail below.

Accordingly, the processing system may be any form of processing system suitably programmed to present content instances to the user, as will be described in more detail below. The processing system may therefore be a suitably programmed computer, interactive television, interactive radio, mobile phone, PDA, Walkman or the like.

An overview example of the manner in which the invention may be implemented using the processing system 10 will now be outlined with reference to the flow chart of Figure 2.

In particular, at step 100, a respective content instance is displayed to the user. This may be achieved by having the user select a content instance from a list, or the like. Alternatively the content instance may be selected automatically by the processing system, or the like. This will depend on the respective implementation. Thus, for example, if the content instances are images, the user may be presented with a number of thumbnail images, allowing a respective content instance (image) to be selected. Alternatively, the content instances may be web pages, in which case, the first content instance may a home page on a web site, or the like.

In any event, at step 110, the user responds to the presentation of the content instance. The manner in which the response is made will depend on a number of factors, and will be discussed in more detail below. However, the response may for example be a rating relating to the user's appreciation of the content instance, an indication of the length of time the content instance is viewed for, the purchase of an item in response to an advert, or the like.

In any event, at step 120, the response is obtained by the processing system. The response may be used by the processing system to select a next content instance at step 130. The next content instance is selected using a content network, which sets out for each content instance, one or more links to other available content instances. In particular, the processing system presents the next content instances in accordance with the links and any request for further content which is determined from the responses provided by the user.

The next content instance is then displayed to the user at step 140, allowing the user to again provide responses at step 110. The steps 110 to 140 may then be repeated a number of times, allowing the user to view a number of different content instances associated with each other via respective ones of the links. The viewed content instances then form a particular sequence of content instances.

At step 150, the processing system uses the one or more of the responses and predetermined criteria to assess the ability of one or more of the content instances in the sequence to satisfy predefined objectives.

At step 160, the processing system then modifies the content network in accordance with the determined ability, which in turn modifies the content instances that will be displayed in future. Repeating this process iteratively enables the content network to be optimised to allow content instance sequences that are more successful at satisfying the predetermined objectives to be presented in future.

The modification of the content network may be achieved in a number of ways. However, in one example, this is achieved by assigning weightings to each of the links between respective content instances. The weightings are then modified depending on the success of the ability of the content instances to meet the objectives. The weightings are then used to control which content instances are presented in future, allowing the content instances that best satisfy the objectives to be used more often.

Thus, for example, each content instance may correspond to a web page on a web-site,

with the desired objective being to keep users interested in the site, so that they browse the site for as long a time as possible. Accordingly, in this case, the responses are indications of the time which users spend on each web page in a particular sequence of web pages defined by the content network.

This effectively allows the processing system 10 to assess the ability of the particular web pages or web page sequences to retain the user's interest. The processing system then uses this information to modify weightings associated with respective web pages sequences, thereby modifying the web pages to be presented in future. Repeating this procedure allows the success of a range of different web page sequences to be evaluated, to allow the more successful content image sequences to be developed.

Thus, preferably the system is operated for a sufficient period of time to allow a statistically significant number of users follow at least some of the individual links (and preferably those links which are later updated). Each link is judged according to the ability of the subsequently presented content instances to satisfy the predefined objectives.

An example of the broad form of formula that may be used is:

$$Q = W / n \qquad (1)$$

Where

- Q is the quality of the link
  - W is the total weightings for all desirable things performed by all users who followed the link, and
  - n is the number of users who followed the link.

However, it will be appreciated that the modifications to the links weightings may be achieved in other ways, and in accordance with other formulas.

An example of a content network is shown in Figure 3. As shown the content network includes a number of presentation instances 40, 50, 60, 70, 80, ..., (N-1), N0. Each presentation instance is associated with one or more corresponding content instances C1,

C2, ..., C10, with each content instance C1, C2, ..., C10, being associated with one or more different presentation instances 40, 50, 60, 70, 80, ..., (N-1), N0.

It will be appreciated that in general each content network would include a large number of presentation instances, to allow each content instance to be represented one or more times within the network, possibly in combination with different content instances. However, only a small number have been shown in this example for clarity.

Each presentation instance 40 has a number of associated request options 41, 42, 43, 44 associated therewith. Each request option represents a possible request for further content from the user. Typically the request option will be determined from a response that the user may make following display of the respective content instance(s) C1, C2, ..., C10. Associated with each request option are one or more respective links, 41A, 41B, 42A, 43A, 44A that link the presentation instant to subsequent presentation instances 50, 60, 70, 80, ... , (N-1), N0, as shown.

This allows the processing system to determine the next content instance(s) C1, C2, ..., C10, that may be displayed.

Thus, for example, when the processing system 10 presents the content instances C1, C2 associated with the presentation instance 40 to the user, the processing system will examine any response to determine if it includes a request for further content. If so, the processing system 10 determines which of the request options 41, 42, 43, 44 the request corresponds. The processing system 10 selects a respective link based on the determined request option. Thus for example, if the user selects a response corresponding to the request option 41, the processing system 10 may select either one of the links 41A, 41B, allowing either one of the content instances 60, 70 to be presented to the user.

Each link has a respective weighting assigned thereto, as will be described in more detail below. In the event that a selected request option 41 has multiple links 41A, 41B associated therewith, the processing system may select one of the links 41A, 41B, and

hence one of the content instances 70, 60 in accordance with the weighting. Thus for example, if the link has a weighting "10", which the link 41B has a weighting "20", then the link 41B may be selected twice as often as the link 41A. However, alternatively, each link could be selected an equal number of times.

In general, the content network is maintained by storing data representing each of the presentation instances in the database 11. In particular, the database would typically include at least a content table storing details of each content instance, a presentation table storing details of each presentation instance, a link table for storing details of each link. The processing system 10 can then modify the content network by updating the tables in the database, as will be appreciated by those skilled in the art.

Detailed Description

A specific example of the invention in which the processing system is adapted to present web pages containing images, or the like, to users of remote end stations will now be described. A system suitable for performing this is shown in Figure 4.

As shown, the system includes a base station 1 coupled to a number of end stations 3, via a communications network 2, and/or via a number of local area networks (LANs) 4. The base station 1 is generally formed from one or more of the processing systems 10 coupled to the data store 11, as shown.

In use, users of the end stations 3 can access content instances, generated by the processing system 1. It will be appreciated from this that the system may be implemented using a number of different architectures. However, in this example, the content instances include web pages, with the communications network 2 being the Internet 2, and the LANs 4 representing private LANs, such internal LANs within a company or the like.

In any event, it will be appreciated that in this example, the processing systems 10 must be capable of generating web-pages or the like, as well as monitoring responses generated by the end stations 3, and updating the content network, as described above. It will therefore

be appreciated that the processing system 10 may be formed from any suitable processing system, which is capable of operating applications software to respond to the end stations, and update the content network. Accordingly, the processing system 10 is typically a web-server, or the like, which is coupled to the Internet 2, via the external interface 25, as will be appreciated by persons skilled in the art.

Similarly, the end stations 3 must be capable of co-operating with the base station 1 to allow browsing of web-pages, or the transfer of data in other manners. Accordingly, in this example, as shown in Figure 5, the end stations 3 are formed from a processing system including a processor 30, a memory 31, an input/output (I/O) device 32 and an interface 33 coupled together via a bus 34. The interface 33, which may be a network interface card, or the like, is used to couple the end station 3 to the Internet 2.

It will be therefore be appreciated that the end station 3 may be formed from any suitable processing system, such as a suitably programmed PC, Internet terminal, lap-top, hand-held PC, mobile phone, PDA, or the like, which is typically operating applications software to enable web-browsing or the like.

In any event, the manner in which content instances in the form of web pages can be displayed to users of the end stations 3 will now be described with reference to Figures 6A and 6B.

As shown in Figure 6A, the user of the end station 3 logs on to the base station 1 at step 200. In order to achieve this, the user will typically be provided with a username and password, copies of which are stored at the base station 1. This allows the username and password, and hence the identity of the user, to be subsequently verified. The manner in which login may be achieved will be appreciated by those skilled in the art and will not therefore be described in any further detail.

As a result of the login procedure, the base station 1 will determine a user ID representative of the identity of the user. The base station 1 will also generate a session ID

representative of the respective session in which content instances are presented, as will be appreciated by a person skilled in the art.

It will be appreciated that users may not wish to perform registration procedures to provide information. Accordingly, user ID and session IDs may be determined through the use of cookies instead, thereby preventing the need for user names and passwords to be provided.

In any event, at step 210 the base station 1 determines a first presentation instance to present to the user. This may be for example a web page including one or more content instances thereon.

In any event, in this example, each web page is designed to be rated by the user on a scale of one to four. Thus, in this example, the user rating "one" corresponds to information that the user rates as "good", whilst the user rating "four" corresponds to information which the user rates as "bad" with intervening ratings corresponding to "average" and "poor" respectively. In any event, it will be appreciated that the exact nature of the information is not essential to the present invention. Accordingly, the information may correspond to, images, video clips, music, text information, portions thereof, combinations thereof, or the like.

In any event, at step 220 the base station 1 generates a log entry. The log entry is used to record exactly what information was displayed to the user, together with an indication of any responses that may be received from the user. Accordingly, the log typically includes indications of:

- Content ID(s) representative of the current instance(s) being displayed
- A presentation ID representative of the presentation instance
- A link ID representative of the link followed to reach this presentation instance
- The user rating for the previously presented presentation instance
- The user ID
- The session ID

It will be appreciated that the log entry generated for the first presentation instance to be displayed, will not include a link ID or user rating.

Accordingly, if the first presentation instance presented is the presentation instance 40, an example of the log entry for the presentation of the presentation instance 40, may be as shown in Table 1.

Table 1

Content ID	Presentation instance(s) ID(s)	Link ID	User Rating	User ID	Session ID
40	C1, C2			UID1	SID1

In any event, at step 230 the base station 1 transfers the web page associated with the respective presentation instance to the end station 3 for presentation to the user. The web page including the content instances C1, C2, is presented to the user by the end station 3 at step 240. The user responds to the content instances, which in this example involves rating the content on a scale of "one" to "four". In this example, the user rating will typically be selected by selecting an appropriate link, such as a hyperlink on the web page.

An indication of the specified rating is transferred to the base station, to allow the base station 1 to determine the user's response and rating at step 260 and 270. In this case, the response is the rating. However, if alternative forms of responses are used, this may require that the processing system 10 interpret the response to determine a user rating therefrom, as will be described in more detail below.

It is also possible that the response will not include any form of rating but, instead is used simply to judge the user's behaviour, such as whether the relevant content instance was viewed by the user, and whether this led the user to view further content. However, this behaviour can be interpreted as a form of rating by the processing system 10, and it will therefore be appreciated that the general techniques described below can be applied even in the event that no explicit rating is provided by the user.

After determining the user rating at step 270, the base station 1 examines the response to determine if it includes a request for further content instances to be presented to the user at step 280. In particular, in this example, after rating the respective presentation instance, the user is presented with a further presentation instance, which is selected based on the rating given to the previous presentation instance. The request for further presentation instances to be presented may be inherent or explicit within the response.

If it is determined that no further content instances are to be presented at step 290 then the base station 1 generates a log entry at step 300, which includes the rating given to the presented presentation instance. The presentation procedure for this session then ends at step 310.

Otherwise the base station 1 operates to determine which request option corresponds to the request provided in the response at step 320.

Thus, in the above example, if the first presentation instance displayed to the user is the presentation instance 40, then the presentation instance includes four associated request options 41, 42, 43, 44, each of which corresponds to a different user rating "one", "two", "three", "four". Thus, if the user selects the rating "one", then the processor determines that the request option 41 has been selected.

Accordingly, from this the base station 1 determines that it must select a respective one of the links 41A, 41B that are associated with the request option 41. The manner in which this achieved depends on the particular implementation.

Thus, for example, the base station may be adapted to ensure that the links are selected in accordance with the weightings, such that links with greater weightings are selected more frequently than links having lower weightings. Thus as briefly outlined above, if for example the Figure 41A has a weighting "ten" whereas the link 41B has a rating "5" then the link 41A will be selected twice as often as the link 41B.

However, in this example, the processing system is adapted to ensure that the links 41A, 41B are selected with equal probability such that each link 41A, 41B is used a similar number of times as the number of times the respective request option 41 is selected increases. Accordingly, in this example, the weightings are not used to control which link is selected.

In any event, once the processing system 10 has selected a link at step 330, the base station 1 uses the link to determine the next presentation instance to be presented to the user. Thus, for example, if the link 41A is selected the presentation instance 60 is then presented.

At step 350 the base station 1 generates a log entry including an indication of the selected link.

Thus, an example of the log including the new log entry is as shown in Table 2.

Table 2

Content ID	Presentation instance(s) ID(s)	Link ID	User Rating	User ID	Session ID
40	C1, C2			UID1	SID1
60	C5, C6	41A	"one"	UID1	SID1

The processor then returns to step 230 and transfers the respective content instances to the end station 3. It will be appreciated that the procedure outlined in steps 230 to 350 is then repeated as required and in particular, as often as often as necessary in accordance with responses received from the user.

Accordingly, it will be appreciated that this continues for as long as content instances associated with the selected presentation instances are displayed to the user.

Thus, for example, the log would be extended, as shown for example in Table 3.

Table 3

Content ID	Presentation instance(s) ID(s)	Link ID	User Rating	User ID	Session ID
40	C1, C2			UID1	SID1
60	C5, C6	41A	"one"	UID1	SID1
..	..	..	..	..	..
N-1	C2, C3	(N-2)3A	"Three"	UID1	SID1
N	C7, C8	(N-1)4B	"Four"	UID1	SID1

In any event periodically, the base station 1 will operate to update the content network. In particular, the base station 1 operates to update the content network by analysing the log entries generated during the process described above with respect to Figure 6A and 6B.

This may be achieved in a number of different ways depending on the respective implementation. Thus, for example, the base station 1 may process each log entry as it is created, updating the content network as each response is provided.

However, in this example, which will now be described with reference to Figures 7A to 7E, the base station 1 waits until a predetermined number of logs are created or until a predetermined amount of time has passed since the last processing. This is preferably performed to allow a statistically significant number of users to traverse at least some of the links in the network. More specifically, it is preferably that only links that have been traversed a statistically significant number of times are updated, to prevent spurious results unduly effecting the network configuration.

Thus for example, if a link is updated after only a single user has traversed the link, the updated link will only reflect the ratings provided by that user, and not the effect of a number of users, whom may all rate the associated content instances differently.

Similarly, it is preferable that new links are only created for request options that have been selected a statistically significant number of times, for similar reasons.

In any event, as shown in Figure 7A, the process may be achieved by having the base station 1 obtain the log entries for a respective user and/or session at step 400. This will be achieved using the user and session IDs stored in the log entry as will be appreciated by those skilled in the art.

At step 410 the base station 1 determines the user rating for each presentation instance from the log entries. The base station uses this to modify the weighting of each link selected during the presentation of the content instances to the user during the respective session.

In particular, at step 420, the base station 1 then modifies the weighting of each link selected in accordance with the user rating assigned to one more of the presentation instances after the link. Thus, the weighting of the link is modified to represent the success of the presentation instances presented after the link is followed, in satisfying the predefined objectives, as determined from the user's responses.

The modified weighting is determined using the equation:

$$W = W + R * (d \wedge n) * b \qquad (2)$$

Where:

- *W* is the weighting of the link.
- *R* is the value assigned to the user rating associated with each presentation instance after the link. If the content instances associated with a presentation instance are repeated later (that is, we have already seen it in our backward log analysis), *R* is made to be a constant negative value set specifically for repeats.
- *d* is the rate of decay, imposed to apply declining importance to links as they are separated by more and more pageloads.

- *n* is the distance between the current link and the one subsequently followed by the user)
- *b* is a bonus awarded if the user has been referred to the site for the first time. Otherwise it's set to 1.

Thus, in the example set out above, using the values:

User rating "one" – R= 10
User rating "two" – R= 5
User rating "three" – R= 0
User rating "four" – R= -10

The new link weightings are therefore determined as follows:

$W(N-1)4B = W_o + (-10 * (d_o \wedge n_o) * b)$

$W(N-2)3A = W_o + (-10 * (d_1 \wedge n_1) * b) + (0 * (d_o \wedge n_o) * b)$

$W41A = W_o + (-10 * (d_{N-1} \wedge n_{N-1}) * b) + (0 * (d_{N-2} \wedge n_{N-2}) * b) + .. + (10 * (d_o \wedge n_o) * b)$

Where:

- *Wo* is the original weighting of the link.
- d_{N-1} is the rate of decay, imposed to apply declining importance to links as they are separated by N-1 pageloads.
- n_{N-1} is the distance between the current link and the N-1th link one subsequently followed

It will be appreciated that the effect of this is to increase/decrease the weighting of links depending on the user rating given to content instances presented after the links have been followed. Thus, for example, if a content instance is rated highly by the user, the effect of this will be to increase the weighting of the links the user followed to reach the content instance.

Furthermore, the increase in weighting can be controlled depending on the distance between the respective link being modified and the content instance in the network. Thus

for example, a link that leads to the content instance under consideration is likely to modified by a greater amount than a link further away.

Thus, in the example above, the user rating "four" is applied to the presentation instance (N-1)0. Accordingly, as this is a negative rating, it is likely the weighting of the link (N-2)3A will decrease. Similarly the weighting of the link 41A is also likely to decrease, although as this link is further from the presentation instance (N-1)0 than the link (N-2)3A, the reduction is likely to be smaller in magnitude.

At step 430, a respective rating is assigned to each presentation instance and each associated content instance by the base station 1.

Thus, for example, if the presentation instance 40 is given a user rating "one" then this is used to modify the presentation instance rating of the presentation instance 40, and the content instance ratings of the two content instances associated therewith.

Generally the ratings of the content instance and presentation instance are based on the user rating, so that in this example, a user rating of "one" will correspond to an increase in the content or presentation instance rating of +10. Similarly, a user rating of "four" corresponds to a content or presentation instance rating of –10. In this example, the ratings "two" and "three" are +5 and 0 respectively.

Thus, for example, in the case of the presentation instance 40, if the user rating is “one”, the presentation instance rating 40 and the content instances C1, C2, have respective ratings of 10.

At step 440 the base station 1 determines if all the pending log entries for all respective users and/or sessions have been completed. If not, then the base station proceeds via steps 450 and 460 to obtain the log entries for the next user and/or session, before repeating steps 410 to 440.

During this process, the modified weightings and content and presentation instance ratings are modified in accordance with each user rating assigned thereto, so that if a number of different user ratings are received for a respective content or presentation instance, then the effect of these ratings is combined. This may simply be achieved by dividing the ratings by the number of times the links were traversed or the content instances presented.

Thus, for example, if a respective presentation instance is rated as "one" by five users, and "two" by three users, then the rating of the presentation instance will be modified by 5x(+10) + 3x(+5), giving an overall presentation instance rating of +65/5 = 13.

Normalisation may also be performed on the responses determined for each user. Thus for example, the user ratings determined for each user maybe normalised so that a user who rates every third piece of content "one" has less influence per rating than someone who rarely finds a piece of content worth "one". This can be achieved for example, by considering each of the user ratings supplied by a user, and then normalising these so that the average of the user ratings for each user are the same.

Otherwise, the base station 1 goes on to modify the links based on the weightings. In order to achieve this, at step 470, the base station selects a next request option.

The base station 1 then compares the weighting of the next link associated with the selected request option to a predetermined threshold at step 480. If it is determined that the weighting does not exceed threshold at step 490, the link is defined to be on relative probation, at step 500. Otherwise, the link is defined to not be on probation at step 510. Thus, if a link is on probation, it will be appreciated that the link will be retained on probation, unless the threshold is exceeded.

The probation technique is used to allow the relative success of links to be compared to each other, so that less successful links may be identified and removed. In particular, links are defined to be on probation if they are deemed by the processing system to be less successful. If a link is retained on probation for a length of time, this indicates that the link

is consistently being judged as unsuccessful, placing the link in danger of being removed. If however, at any stage the link is removed from probation, this indicates that the link is successful in some circumstances allowing the link to be retained.

In the case of relative probation, each of the links for a respective request option are rated against each other, to allow the best performing links to be selected and used in future. In this example, the links are rated against each other by comparing the links to a threshold, although other techniques may also be used.

It will be appreciated that the threshold may be set in any one of a number of manners, depending on the implementation. Thus for example, the threshold may be set arbitrarily so that any links having a lower weighting are put on probation. However, typically, this is used to allow the relative success of the links for a given request option to be assessed over a longer, and thus more reliable, period of time. In this case, the decision to place on probation may be based on the weightings assigned to one or more of the other links associated with the respective request option.

In this example, the respective threshold is selected to be equal to or close to the weighting of the highest weighted link for the respective request option, such that all links having a weighting lower than the best performing link are placed on relative probation.

Thus, for example as shown in Figure 3, the base station 1 would operate to compare the weighting of the links 61A, 61B and 61C. In this case, if the links have respective ratings of 10, 5 and 2 respectively, the processing system will operate to place/leave the links 61B, 61C on relative probation. Similarly, the link 61A will be removed from/or left off probation.

In any event, at step 520 the base station determines if each link has been considered. If not, the base station 1 operates to compare the weighting of the next link at step 480, as described above. Otherwise, the method proceeds to step 530 at which point the base station 1 determines if each request option has been considered. If not, the base station 1

selects a next request option at step 470.

Otherwise, the base station 1 goes on to compare weighting of the links to an absolute threshold. In order to achieve this, the base station 1 compares the weighting of a next link to the absolute threshold at step 540. If the link is determined to be below the threshold at step 550, then the link is defined to be (or is retained) on absolute probation, at step 560. If the link is above the threshold at step 550, then the link is defined to not be on probation at step 570.

Again, it will be appreciated that probation need not be used, and that links could instead be retained or rejected on the basis of the comparison. However, in general, this does not allow an assessment of the link to be made over as long a period of time, which can result in good links that are generally successful being removed. A more complicated system of link judging over time may also be used, where for example, very poor recent performances lead to deletion quicker than moderately poor ones and/or other considerations are applied to the link.

The technique being discussed currently operates to compare the weighting of each link to an absolute threshold. This allows the relative success of each of the links with respect to each other to be judged. In this case, the absolute threshold may be set arbitrarily, or in accordance with the weighting of all links, or some of the links. Thus, for example, the threshold may be based on the sum of the weightings of each of the links to allow for example the lower 5% weighted links to be defined as being an absolute probation.

In any event, it is determined at step 580 whether each link has been considered. If not, the base station 1 compares the next link to the absolute threshold at step 540.

Once all links have been considered, the base station 1 deletes a predetermined number of probation links at step 590. The number of links deleted can be selected to allow the rate at which the content network is changed to be controlled. Accordingly, it will be appreciated that any number of links may be deleted. However, in this example, 1% of

links that have been defined as probation links for the longest period of time are deleted.

In order to achieve this, the base station 1 will maintain a record each time the content network is updated of which links are defined as rather relative or absolute probation links. The base station 1 will then determined which of these links has remained as an absolute or relative probation link for the longest period of time (i.e. for the most successive revisions of the content network). Once this has been determined, the 1% of links are removed.

Accordingly, this allows the base station to periodically determine which links are consistently performing badly, allowing these links to be removed. By removing a larger number of links, this will cause more radical changes to the content network. Whilst this can help large changes to be implemented swiftly, this will generally provide less time for links to be assessed before they are rejected, and accordingly, this may only allow the network to be optimised to a point. Accordingly, the number of links that are removed can be controlled to allow the rate and degree of optimisation provided to be controlled.

It will be appreciated that, for the purpose of alternative systems, this is also the case for controlling the number of content instances that are added to the content network, the number of presentation instances that are created, and the number of times a content instance is repeated within different presentation instances within the content network.

The links are defined in terms absolute and relative probation, as this allows the links to be identified and removed as follows:

- Absolutely – identifies links that are performing the worst out of the entire pool of links on the site.
- Relatively – identifies links that links are performing badly relative to other link(s) on the presentation instance that have been grouped together for that user behaviour (e.g. selecting one option, or choosing "next" within a certain time period). Relative comparisons are useful because where there are multiple links on a choice, the random distribution of users to each link allows for an empirical scientific determination of the superior link.

Once the links have been removed, it is then necessary to update the content network to include new links, to replace those that are lost, as well as to include new presentation instances and remove unused presentation instances.

It will be appreciated that any presentation instances that do not have any links pointing to them as their destination may be deleted now, before the new links are created. Alternatively, the new links may be created first, although it may be undesirable to allow the new links to be created to these presentation instances that have had links removed as this is an indication that these presentation instances are not performing well.

The links are generally created on a regular basis in areas of the content network where:

- Existing links are performing badly
- There is a lot of traffic
- There are no links

In order to achieve this, the base station 1 compares the request options and the links to one or more predetermined criteria at step 600, so as to determine a link pool, which is a list of new links to be created, at step 610. In particular, comparing the request options and links to the criteria allows the request options and links to be assessed to determine their ability to meet the predefined objectives that the content network is designed to satisfy. It will be appreciated from this that any number of criteria may be used.

Typically, the base station will select the new links that need to be created based on:

- Presentation instances which no longer have links extending from them (ie. Presentation instances that are no longer the source of any links).
- The top 0.5% of request options which do not have links.
- The top 0.5% most unimproved links given by Wp / W where W is the current weighting and Wp is the previous weighting

- The top 0.5% response options losing the most traffic given by W / n ^ r where W is the current weighting, n is the amount of traffic received and r is a fraction which reduces the impact of the of n.

At step 620, the base station 1 compares the content instances to one or more predetermined criteria.

Again, this is performed to allow the base station to determine a content instance pool of content instances, which are to act as destination content instances for the new links to be created, at step 630. In this example, the request options from which the links are provided will now be referred to as source request options, with the content instances to which the links extend being destination content instances. Thus in the case of the link 41A in Figure 3, the request option 41 is the source request option with the content instances C5, C6 being the destination content instances.

In general content instances satisfying one of the following criteria are selected:

- Content instances which are yet to be tried out in the system
- Content instances which are getting relatively good subjective ratings in their own right
- Content instances whose links are getting relatively good weightings
- Content instances which match the known categories of the content instance on the referring presentation instance
- Content instances that got good subjective ratings by users who viewed the exhibited the behaviour for which this link will be slotted for.
- Content instances that got good weightings from users who viewed the exhibited the behaviour for which this link will be slotted for.

This may be achieved in any one of a number of ways. However, in this example, the base station 1 selects:

- The top 1% of content instances with the fewest associated presentation instances
- The top 1% highest rated content instances

- The top 1% of content instances having the most improved ratings
- A combination of the above three according to the following formula:

$$(W \wedge 2) / (n + 1) / p \qquad (3)$$

where

- W is the current weighting,
- n is the number of presentation instances and
- p is the weighting given on the previous run.

Once the content instance pool has been created, it is necessary to consider combinations of links and content instances, to allow the most suitable content instances to acts as destination content instances for each link. In particular, this is performed to attempt to satisfy the following aims:

- Users who select the respective request option will give the content instance high subjective ratings; but
- Is not likely that the user has (at least recently) viewed the content

These aims might sound contradictory but, consider that:

- Half of the time, the content instance occurred after the presentation instance and this new path may lead to the user not seeing that the presentation instance(s) that showed the image.
- We allow content instances to repeat themselves at a respectable distance.

This is achieved by having the base station 1 examine every possible combination of link and content instance, contained in the link and content instance pools, to allow the most suited links and content instance combinations to be determined. This is achieved by having the base station examine the logs to assess each combination as will now be described.

Thus, the base station 1 selects a new link from the link pool at step 640, and a content instance from the content instance pool at step 650.

At step 660 the base station 1 then operates to determine the proximity of previous occurrences of the respective content instance in the content network. Thus, the base station 1 assesses for the location of the source request option in the content network, the number of links which must be traversed backwards through the content network until another occurrence of the selected content instance is reached.

Thus if a new link is to be created in the content network map of Figure 3, with a source request option 63 and a content instance C1, the base station would determine that another version of the content instance C1 can be reached via the link 41A.

In particular, if the selected destination content instance occurs before the respective source request option, a close proximity weighting is determined in accordance with the equation:

$$X = X + 1 / (P - p) \wedge r \qquad (4)$$

Where

- X is a weighting for how closely the pageloads are for this image and presentation instance.
- P is the pageload number of the presentation instance
- p is the pageload number of the image
- r is the rate of decay – a number between 0 and 1 representing the declining importance of content instances repeating as they co-occur further and further apart.

This is done to reduce the chance of user's being presented with identical content instances after following only a few links. This is important because users are unlikely, in this example, to want to be presented with the same content instance repeatedly. This may unduly influence further modification of the content network, but also means that the predefined objectives, which in this example include presenting as many content instances as possible, are less likely to be satisfied.

After determining the proximity weighting, the base station 1 operates to determine users' ratings assigned to the content instance by users that have previously selected the respective source request option during the presentation of content instances by the network. The user ratings are determined to allow the base station 1 to judge the success of the respective content instance at satisfying the predetermined objectives of the web site for particular users.

In particular, this is done so that it can be assessed how users that have previously selected the respective source request option have rated the content. The reason for this is that different users having similar tastes will tend to apply similar ratings to the same content instance. Furthermore, as the ratings influence which content instance is presented to the user next, it is likely that users having similar tastes will select the same request option at a given presentation instance.

Accordingly, in this example, the aim is to provide content instances that are rated highly by the users. Thus, using a destination content instance that has previously been rated highly by a user that has selected the respective request option increases the chance of the selected content instance being rated highly by future users of the system.

Thus, if the selected request option presentation instance was selected by a user that has also rated the respective content instance, the base station 1 operates to:

- Update an increment of common request options c; and,
- Add to a weighting for the content instance in accordance with the equation:

$$I = I + i \qquad (5)$$

Where

- I is the total weighting for people who selected the request option and
- i was the weighting corresponding to the user rating provided by the user for the respective content instance

At step 680 the base station 1 assesses the similarity of the destination content instance and the content instances in the source presentation instance. This is performed to allow at least some similarity between the images to be provided. Thus it will be appreciated that users will generally prefer to see images which are at least to some extent similar to the previously presented content instances. If widely differently content instances are displayed immediately adjacent to each other, or immediately after each, this is likely to result in the user losing interest in the presented content instances. This in turn may cause the user to leave the web site, which in this example, means the objective of keeping the user interested in the site is unlikely to be satisfied.

In order to determine how closely the selected destination content instance is related to the content instances in the source presentation instance, the content instance are assessed in terms of how many attributes they have in common according to the following fields:

- The individual submitter
- The category the submitter placed it in
- The subcategory the submitter placed it in
- The opinion the submitter thought the user would have of it (funny, interesting, etc)
- The home country of the submitter
- The region of the submitter (Asia, Europe, etc)
- The age group of the submitter
- What the submitter says the image depicts (eg. a person, an animal, a man-made thing, etc)
- The level of education of the submitter

This is achieved by assigning predefined weightings to each type of attribute, to account for the fact that some attributes will be better indicators of similar content than others. Thus, for example, the fact that the same person submitted the image might be 20 times more important than the fact than that the submitter thought users would find it "funny".

At step 690 the base station 1 determines a weighting for each content instance and link

combination in accordance with the proximity, the previous user ratings and the similarity in accordance with the equation set out below:

$$W = (e * I * t * T) / (c * X \wedge R * s \wedge r) \qquad (6)$$

Where:

- *I* is the total user rating for the respective content instance, for all users that selected the respective request option
- *c* is the number of times the selected request option and content instance have co-occurred
- t is the weighting for the similarity of the content instance with the content instance of the source presentation instance
- T is a fraction that reduces or increases the effect of the similarity weighting
- *X* is the close proximity weighting described above
- *R* is a fraction which reduces or increases the impact of the close proximity weighting
- *s* is the number of presentation instances the content instance has had created for it so far.
- *r* is a fraction which reduces the impact of the number of presentation instances

At step 700 the base station 1 determines if each content instance in the pool has been considered for the respective link. If not, the processor returns to step 650 to allow the next content instance to be considered.

If all content instances in the pool have been considered, the base station 1 operates to determine if each link in the pool has been considered at step 710. If not, the base station returns to step 640 to allow the next link to be selected. In this manner, the process is performed until a weighting has been determined for each link and content instance combination.

Following this, at step 720 the base station 1 selects one or more destination content instances for each link in accordance with the determined weightings. Thus, for example,

the base station 1 will first determine how many content instances are to form the destination content instances for a particular link. The base station 1 will then select the content instances which in combination with the link have the highest weighting.

Having assigned one or more content instances to each link at step 720 the base station 1 determines a proportion of the new links that are to connect to new presentation instances as opposed to existing presentation instances at step 730. This is performed to ensure that new presentation instances are created to thereby further improve the effect of modifications to the network. It may be set according to how large the content network currently is relative to how large it is allowed to grow.

At step 740 the base station 1 selects a next link to be created from the link pool. The base station 1 then determines if the required number of links to existing presentation instances have been made at step 750. If it is determined that this is not the case at step 760, the base station 1 operates to determine if a suitable presentation instance already exists within the content network at step 770.

In particular, a suitable presentation instance will be a presentation instance that includes the one or more content instances that have been selected as the destination's content instances for the respective link.

If it is determined that a suitable presentation instance exists at step 780 the base station 1 operates to create a new link to the existing presentation instance at step 790. In this case, if a number of suitable presentation instances exist, the base station will randomly select one of the existing presentation instances for use as the destination presentation instance.

Otherwise, if no suitable presentation instance exists, or if the required number of links to existing presentation instances have been made, the base station 1 operates to create a new presentation instance including the respective one or more content instances, at step 800. The base station 1 then operates to create the new link to the new presentation instance at step 810.

It will be appreciated by those skilled in the art that this is achieved by defining a new entry in the presentation instance table, and a new link in the link table, in the database 11.

At step 820, the base station 1 generates additional links from the new presentation instance to other presentation instances in the network. Thus, the base station 1 operates to generate links in which the new presentation instance is the source presentation instance, with existing presentation instances in the content network acting as the destination presentation instances.

The new links are created by randomly selecting links from any of the following:

- A "sibling" presentation instance – a destination presentation instance for the same choice as the current one, provided there is one.
- A "cousin" presentation instance– a destination presentation instance for a different choice for the same source presentation instance, provided there is one.
- A "parent" presentation instance – the links of the source presentation instance, provided there are others.
- An "unrelated clone" presentation instance – the links of presentation instance with the same one or more content instances.

In any event, at step 830 the base station 1 operates to determine if all links in the pool have been created. If not the base station 1 returns to step 740 and selects the next link to be created. Otherwise the process ends at step 840.

Additionally, once the process is completed, the base station 1 can delete or archive any presentation instance which have no links pointing to them, before deleting or archiving any content instance which are no longer associated with any presentation instances.

The base station 1 removes these presentation instances and content instances as this indicates it is determined that these content instances are no longer of sufficient interest to be maintained within the content network.

It will be appreciated from the above, that the content network is updated by updating the content network tables in the database, as will be appreciated by those skilled in the art.

Thus, for example, the base station 1 updates the tables stored in the database 11, to include the new links and presentation instances, such that the table contents now reflect the modified content network. In addition to this, the base station 1 can update a front end table (called DisplayLinks), includes the links table combined with redundant information from the presentation instance and content instance tables, to allow the base station 1 to need only look up one table for each pageload.

Responses

As briefly outlined above, the nature of the responses used will vary depending on the implementation of the system.

Generally, the responses represent the behaviour of the user subsequent to being presented with the one or more content instances, as determined by the base station 1. The responses may result in the base station 1 causing more content instances to be presented to the user, in which case, the response includes a request (i.e. A request for further content). Furthermore, the base station may evaluate the response to determine a rating, which is used to indicate how successful the presented content instance is at satisfying the predefined objectives.

In the above example, the user rating corresponds to the rating and also to the request, although it will be appreciated that this is not necessarily the case in other examples.

Thus, in the example described above, the user is asked to provide a user rating for the content instance on a scale of "1" to "4". However, other forms of responses may be used.

Accordingly, the responses may be no more than the use of hyperlinks to select alternative pages, either within the specific web site, or within an alternative web site. The system

may set arbitrary ratings for each of these (for example, to apply a higher rating if they remain within the current web site). Or the system may simply rely on predefined criteria unassociated with the request (such as subsequently purchasing a product), as is discussed elsewhere.

Thus, for example, if the user follows a hyperlink (request option) from a presentation instance to an external web site, and buys a car from the web site as a result of an advert content instance provided on the respective presentation instance, then this may result in the presentation instance, content instance and/or content instance combination being given a high rating. In particular, if the objectives of the system are to encourage user to purchase products, this objective is satisfied and the link used to reach the external web site, and links followed to reach the respective presentation instance will have their weighting increased.

In this case, it is also conceivable that the link also have an indication of the content instance that will be presented. Thus, for example, the link may specify "See this dog riding a surfboard!". This is in contrast to a system where predefined ratings (good, bad, etc) reveal unknown content each time.

A response may even be defined in terms of a non-response, or lack of a response. Thus for example, in the case of interactive radio, each content instance may correspond to a respective piece of content such as an advert, or a song. In this case, the response will be determined from the effect of playing the song or advert. Thus, for example, if the user turns off the radio, selects an alternative station or selects "next song" during a song, this may indicate that the song is not particularly good at retaining the user's interest.

In this situation, the response of changing radio station therefore results in the respective content instances being given a low rating. If however, the user listens to the entire content instance, then this would signify that the content instance is good at retaining the user's interest, so it would receive a high rating. In this case, the lack of a response by the user during the presentation of the content instance is therefore interpreted as a response in

itself by the base station 1. Thus, a user response can be provided in the form of a non-response.

It will be appreciated that the responses can therefore be any response (or non-response) as defined within the base station 1.

A further possibility for responses is for an assessment type of response to be used. This is particularly useful if the content network is used in an educational sense. Thus for example, each response could be an answer to a question provided in a respective content instance. By assessing different manners in which information may be presented, and using the response to determine the types of presentation that more often result in correct answers, allows an educational system to be implemented and improved.

Thus, for example, in an education test, the user may start at a presentation instance 1. If they respond quickly, this indicates they have understood the information easily, so they're sent to presentation instance 2 or presentation instance 5. If they answer slowly, this indicates they have had problems and may require further instruction, in which case they are directed to presentation instance 4 or presentation instance 5.

Furthermore, the users are then tested, and their ability to pass or fail the test is used to update the network, such that links followed that resulted in a pass will retained, whilst those that result in fails will be removed. In this case, it will be appreciated that the response provided by the user may be a combination of the response times and the final test result. Accordingly, it is not necessary that the response provided after the presentation of each content instance is used in modifying the network.

Finally, it will be appreciated that the responses may include implicit or explicit requests, in which case the processing system 10 will respond to the response by providing further content, although this is not essential.

Architectures

As outlined above, the system can be applied to a number of different architectures, and need not be restricted to those outlined above.

Thus, whilst the above defines a web based implementation, the system could be implemented to allow content to be displayed on a single processing system, as shown for example in Figure 1.

Furthermore, the references to database, processor, bus, and other components are made in an abstract sense, independent of hardware. The system may, of course, be distributed across many computers or like pieces of hardware.

Objectives

As described above, the success of links and presentation instances are assessed on the ability of the links and presentation instances to present content satisfying predetermined objectives. In the above example, the objective is to present the users with content they rate highly (and therefore find appealing in some manner).

The objectives of the system may include:

- Maximising the length of time spent on the system
- Maximising the quality of the content seen, as judged by the users
- Maximising the quantity of desirable actions performed by the user (e.g. Buying products, submitting their own content, etc).
- Maximising the quantity and quality of people the user refers to the system
- Minimising the cost of displaying the content – whether it be bandwidth charges or royalties and content licensing fees.
- Maximising the revenue earnt for displaying particular items of content. Here, there may be a blurring of the lines between editorial content and advertising whereby advertisers submit content and pay for it to be shown, but that content is still subject to other criteria listed above (such that the advertising does not overly prevent the satisfaction of other objectives).

- Maximising the return rate of users to the system.
- Ensuring that particular types of users of users visit particular presentation instances.
- That users can afterwards perform a task correctly (e.g. pass a test – in the case of a system existing for educational purposes, or hold desired attitudes – in the case of public interest/community service campaigns, such as knowing not to drink and drive.)
- Producing or discovering content instances (or sequences of content instances) that yield certain responses from users, or make them behave in certain ways. (e.g. refining the exact elements of musical pieces on an album before release, finding the right mix of sequences of events in a video clip that people find most funny for the storyboard of a movie, finding the right blend of colours for a flower arrangement, choosing the most purchase-conducive text for an infomercial). This would be particularly useful using evolving content instances described below.
- Minimising the chance that a user will see the same piece of content more than once. This can be achieved by either or both of :
    - Looking back on the user logs to see if there have been repeats
    - Requiring the user to state that he has seen the piece of content before. (e.g. via a "Seen this before" button.)
- Maximising the ability of users to learn from the presented content instances. This one doesn't have any concrete way of testing specified, which is critical.

Modifications

Weightings for each user may be mathematically adjusted according to what point the user was in his session – presentation instances which tend to be viewed early in a session will have different weightings to ones viewed later.

Also, where the responses include subjective judgements, some users will be inclined to choose some options more than others. For example, more sensitive people may be easily offended and rate content instances as being "Offensive" a third of the time, when the ordinary person is only offended once in every twenty or so content instances. Thus the

effect of an easily offended person clicking "Offensive" could be less than someone who is rarely offended.

Within a world wide web context, and other insecure environments, it is inevitable that automated agents (that is, client-side software programs) will use the site as well, even when forbidden. Measures would need to be taken to ensure that their activity is excluded from the analysis stage. Further, some people will use the system with more regard for making appropriate responses than others. Measures may be taken to reduce the influence "random surfers".

The examples described above operate by deleting and creating links and creating new presentation instances in response to poor performance. However, the system could also be effective in an environment where content can be modified by the system to achieve the system objectives.

This could be done in two ways:

- Content instances themselves can be judged in a similar way to links as described above. Thus, each presentation instance is associated with multiple variations of content instances or content instance combinations and it is chosen randomly which one will be displayed to which user, as it is done with links. The content instances can again have associated weightings that are used to select which content instances are associated with a respective content instance. These are formed form or may be based on the users' subjective ratings and subsequent user activity, again as done with links.
- When new presentation instances are created, the new content is not replicated exactly, but has slight modifications.

The above example also focuses on links between content instances. However, the system can also be adapted to define entry points, allowing the first presentation instance to be selected. These entry points may be static or formed using a different methodology.

Other modifications include:

- Where a particular presentation instance is referred to another user. The presentation instance shown to that new entering user may be a standard presentation instance for that piece of content shown to all users who enter wishing to view that presentation instance.
- Abstract presentation instances that do not hold specific content instances but placeholders that which dynamically find a content instance. For example "the best performing picture of a dog that the user is yet to see" or "one of the better music clip for a genre which we know the user to like". Thus the presentation instance includes respective content instance criteria that are used to select the one or more content instances to be associated therewith.
    - Links may sometimes point to these and thus they can compete with other links on that presentation instance. They would be particularly effective when the user is giving a large number of negative subjective ratings.
    - These placeholders might also be learning decision trees that learn to send users to links, based upon known attributes of the user and to achieve the objectives of the system.
    - The criteria may be based on the content instance rating or weighting, the nature of the content, or the like.
    - A similar effect might be achieved by placing this process in links or content instances, rather than presentation instances. That is, links could decide which destination presentation instance to view, or content instances may decide which content instances to actually display to the user (for more discussion on this, see below).
- A list of the "best presentation instances" for a particular category or keyword which the user may request on demand, each of which are links to be deleted and added like any other. That is, effectively the "best presentation instances" are the ones that have the best weightings – meeting the system's objectives.
- A link might point to a concluding presentation instance, which ends activity. An example of this might be, in the case of an educational system, where the user is taken to a test. If the main objective of the system is for the user to perform well in

the test, the network would naturally change over time to test the user at the best times.

The system does not necessarily require the user to explicitly provide details about himself. These may be inferred based upon the known categories of content types they have viewed and, if available, their subjective judgements thereupon. The demographics of a user (their age, sex, location etc.) may be implied by reference to the kind of person who submitted the content or the kind of person the content was aimed at (e.g.. if a user likes a lot of pictures submitted by 25 year old males, he is implied for practical purposes to be a 25 year old male.). These may be all that is required for the abstract presentation instances above to be effective.

As described above, many content instances can combine to make a single presentation instance. This may be achieved by selecting specific content instances to be included in a respective presentation instance. Alternatively, the content instances associated with a respective presentation instance could be defined dynamically in accordance with predetermined criteria or predetermined instructions, such as software code or the like.

Thus, for example, one person could define a template for describing cars (with fields formed from content instances like colour, make, price) with the template being available for use to other people in the system. The template could correspond to a respective content instance or presentation instance within the content network, with the data used to populate the template being formed from other content instances. Accordingly, when the content instance or presentation instance corresponding to the template is reached via a respective link, the processing system will operate to obtain content instances to allow the template to be populated with data. This will be achieved in accordance with fields in the template, which may specify a respective content instance to be included as data either absolutely or relatively. In the former case, the template will refer to a specific content instance, whereas in the later case, the template will refer to a type of content instance, such as "present a content instance showing features x, y, and z", allowing the processing system to select an appropriate content instance. In either case, the processing system will

populate the template with data in the form of appropriate content instances, presenting the populated template including the instances to the user in the normal way.

Another person could suggest a slight modification to the template (for example, adding a "year of manufacture" field). Then the two templates will be treated as competing content instances or presentation instances. This competition could take place in terms of the popularity of the subsequent presentation or content instances created with each template and/or the popularity of the template with submitters of content. Thus, in the end the most popular of the templates will be used in preference to the other. It will be appreciated that this is typically achieved by having the templates compete against each other as described in the example above for content instances.

Alternatively, new content instance types could be submitted which can be applied to the data of other content types (e.g.. to give effect to this the user could add a "year of manufacture" field but make it not compulsory). The system could thus test this content instance type against existing content instance types.

In this way a large number of content instances can go to make a single presentation instance where all content instances are tested and refined over time, in the ways described above. Content instances may include:

- Subsections of a presentation instance – for example the top navigational area, brand logo.
- Templates for subsections of a presentation instance – (e.g.. particular formats of link lists)
- Functional units that actually interact with the user and cause data to be stored and retrieved (e.g.. online voting systems, auction proxy bid resolving systems).
- "Suggested links" to other presentation instances within the system.

The content instances may be any form of content, such as pictures, musical pieces, video clips, news articles or particular instances of structured information, the latter for instance might be the particulars of a car. Each piece of content may have predefined categories.

In any event, it is also possible for the content instances to be layered with the presentation instances. Thus, for example, a first parent content instance may be provided in the presentation instance, which the causes the processing system to display further child content instances. These parent/child relationships may be defined by contributors or editors of the content instances. Alternatively, they may be developed in a similar manner to the development of the content network described in the example above.

In any event, this is usually achieved by providing respective instructions, such as in the form of executable code associated with the parent content instance. Accordingly, when the processing system 10 attempts to present the parent content instance, the processing system will determine that executable code is present and operate to execute the code.

The code will typically define the relationships to child content instances. This may be achieved absolutely, by specifying a respective content instance, or relatively, for example, by specifying a type of content instance that is to be displayed as the child.

For example, a kitchen content instance may be presented, which in turn requires the presentation of the following content instance types: a dishwasher, cupboard and kitchen sink. Accordingly, in this case, the processing system 10 selects content instances for each of these types to fill their places.

Content instances might also not display information but execute programming code or read data. It may help select other content instances or form processing interrelationships with other content instances.

Content instances could actually be thought of as classes within an object oriented framework. Accordingly, content types could be abstract objects inherited by content instances. The actual interrelationships could be specified by the contributor – some contributors being programmers creating and modifying classes and other contributors using functional code written by programmers to submit content in a user friendly manner.

In either case, the contributor may have the power to specify what objects may call it and what objects it calls.

This could in turn be qualified by the system where combinations of objects (whether abstract or actually displayed) are rated according to how well they meet the objectives. Thus, just as elsewhere, the performance of the relevant presentation instances would influence how often and by whom they are seen, as well as influence the creation of new, potentially similar presentation instances.

Relationships between content instances might also be achieved with a more free-form system where related content instances are described in metadata or the like.

Each content instance may be fixed and unchanging (such as songs lifted from albums, movies, etc), or the system might have the ability to make modifications to the content instance based upon altering elements. For example, this may be achieved by changing the input formula of a fractal, making an explosion more fiery with special effects, changing the pitch of a music track at a particular point, text modifications to a particular article, evolving programming code using genetic algorithms, etc.

These modifications could be made by the system automatically (e.g.. slight variation to a constant in a fractal formula, changing the size or compression method in a movie clip) or in response to user's suggestions (e.g.. the user suggests an alternative ending to an article, alternative wording in an advertisement).

Throughout the above discussion, the roles of the content instances, presentation instance and links are well defined. Thus, the links are used to control the presentation of subsequent content instances, with the weightings of the links being used to control which links are created or destroyed. The ratings determined from the responses and applied to the content instances are then used to select which content instances become the destination content instances for new links. However, it will be appreciated that the roles

of these elements (i.e. the content instances, presentation instance and links) may be altered, and specifically interchanged.

Thus, for example, the ratings given to the content instances or content instance combinations could be used to select which links are created or destroyed, with the link weightings being used to select which content instances are used as the destination content instances for respective links.

Similarly, the ratings could be applied to presentation instances, to allow evaluations to be made.

Furthermore, the links and/or request options could be used to dynamically select the content instances that are subsequently displayed. Thus, for example, if a specific response option is reached, the processing system 10 can be adapted to determine instructions or criteria associated with the response option indicating which link (if within a request option) or destination presentation instance (if within a link) is to be chosen. This is in contrast to the example detailed above, where the link was chosen randomly from the links associated with the response option.

However, the link may alternatively be selected in accordance with the criteria, to ensure the best content instances are subsequently presented to the user. This may be achieved for example, based in information regarding the user, such as age, sex, height, interests, etc. In this case, the instructions may specify which link should be selected for which set of interests, sex or the like.

Instructions can also be provided in the links or presentation instances themselves, again to control the display of information in accordance with the user. Thus, for example, the presentation instance may be for displaying car ad content instances. In this case, when a specific presentation instance is to be presented, the content instances associated therewith may be selected such that women view a different car to men, or the like.

Further, the criteria might not be hard-and-fast (eg. if "Good" then request option 3), but by weightings or qualitative means (eg. the younger the user is, and the closer his proximity to New York, the more likely he will see request option 3).

It will also be appreciated by persons skilled in the art, that the roles of the presentation instances, links and content instances may be interchanged as far as updating the content network is concerned.

Furthermore, it will be appreciated that if only one content instance is presented to the user at a time, then there is a direct correspondence between the content instances and the presentation instances. In this case, presentation instances may not need to be provided, with the links in the content network simply interconnecting content instances directly.

Accordingly, the above is an example of a system and a method for modifying the manner in which content is provided to a user. The technology decides which content should be shown to the user and in what order in response to the user's ongoing feedback, in order to meet predefined objectives of the system. In particular, the techniques apply to content such as images, text, and multimedia content presented via the internet, interactive radio, interactive television or the like.

The system operates by constructing a network of presentation instances and then displaying the associated content instances to the user, in accordance with the network structure and user inputs. In addition to this, the system also operates to modify the network structure in accordance with inputs from the user, to thereby control which content instances that are presented to the user.

Persons skilled in the art will appreciate that numerous variations and modifications will become apparent. All such variations and modifications which become apparent to persons skilled in the art, should be considered to fall within the spirit and scope that the invention broadly appearing before described.

Dated this 19th day of August, 2003

RAPID INTELLIGENCE PTY LTD

By his Patent Attorneys

DAVIES COLLISON CAVE

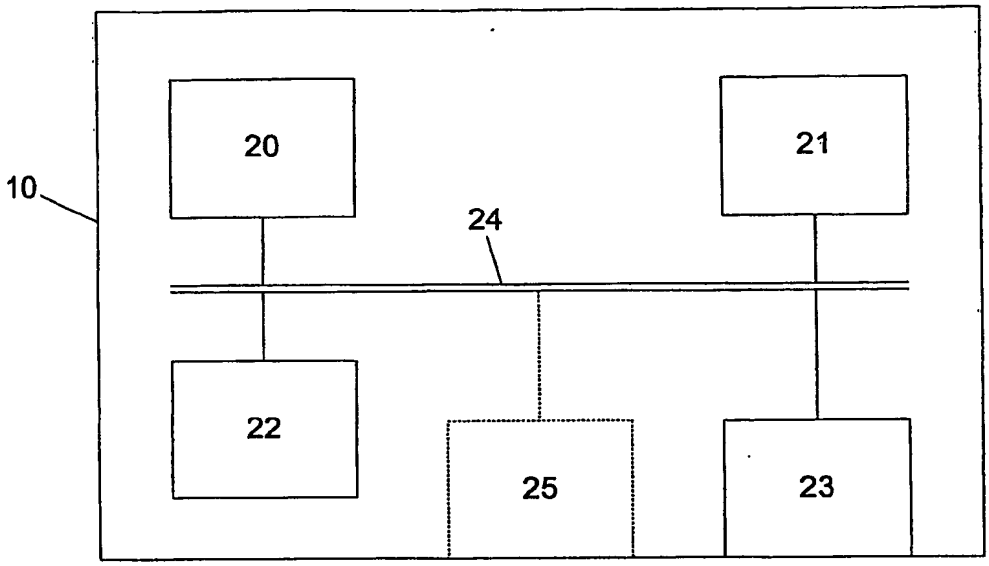


Fig. 1

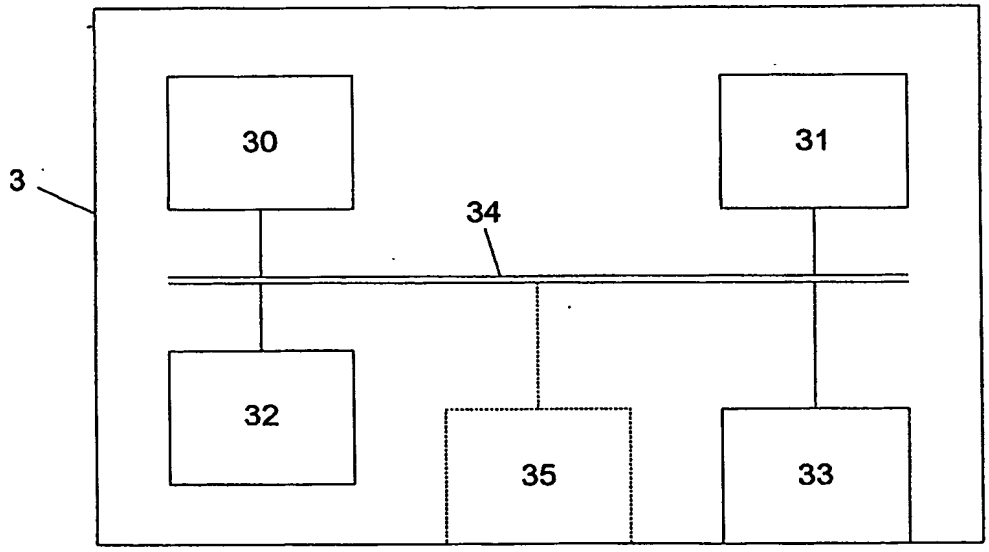


Fig. 5

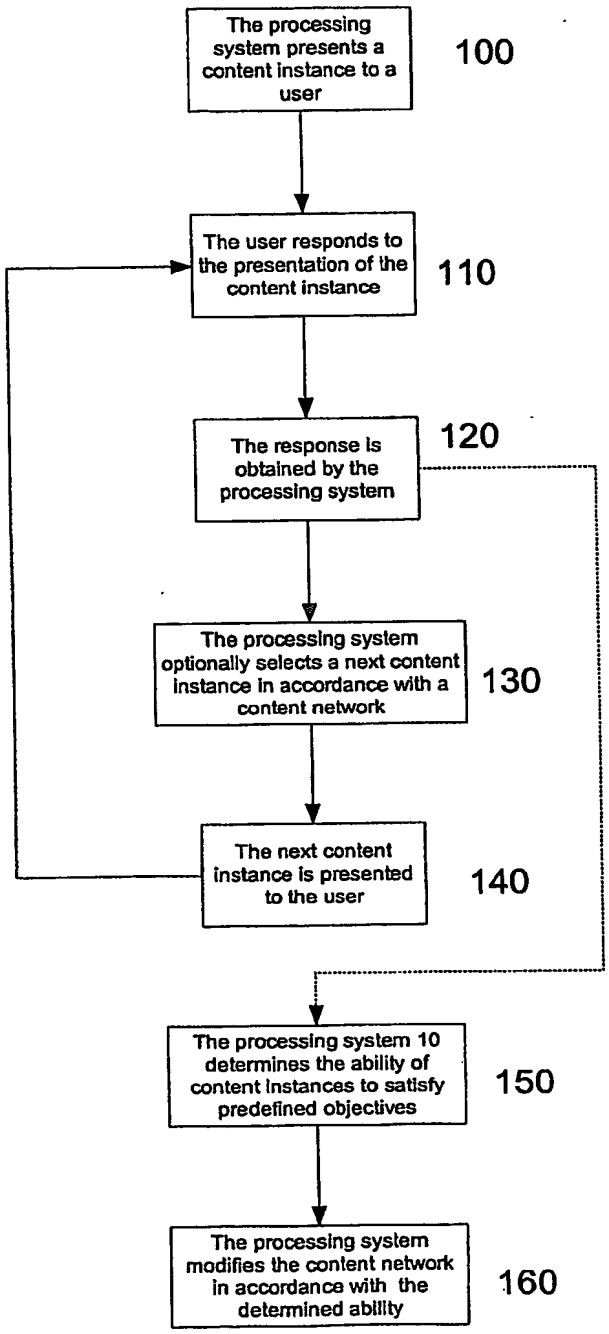

The processing system presents a content instance to a user
100
The user responds to the presentation of the content instance
110
The response is obtained by the processing system
120
The processing system optionally selects a next content instance in accordance with a content network
130
The next content instance is presented to the user
140
The processing system 10 determines the ability of content instances to satisfy predefined objectives
150
The processing system modifies the content network in accordance with the determined ability
160

Fig. 2

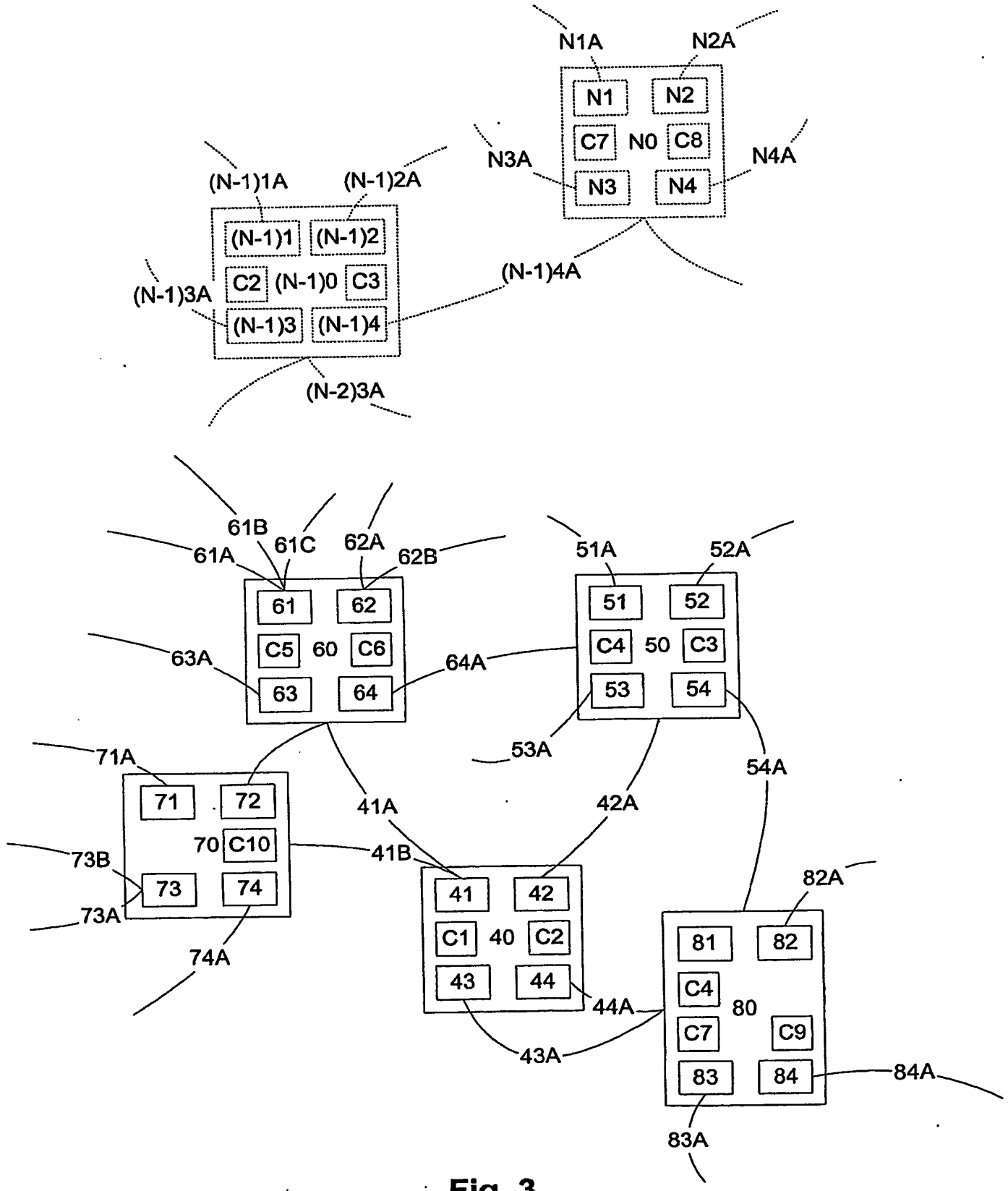

N1A
N2A
N1
N2
C7
N0
C8
N3A
N4A
N3
N4
(N-1)1A
(N-1)2A
(N-1)1
(N-1)2
C2
(N-1)0
C3
(N-1)3A
(N-1)4A
(N-1)3
(N-1)4
(N-2)3A
61B
61C
62A
61A
62B
61
62
C5
60
C6
63A
64A
63
64
51A
52A
51
52
C4
50
C3
53
54
53A
54A
71A
71
72
70
C10
41A
42A
41B
73B
73
74
73A
74A
41
42
C1
40
C2
43
44
44A
43A
82A
81
82
C4
80
C7
C9
83
84
84A
83A

Fig. 3

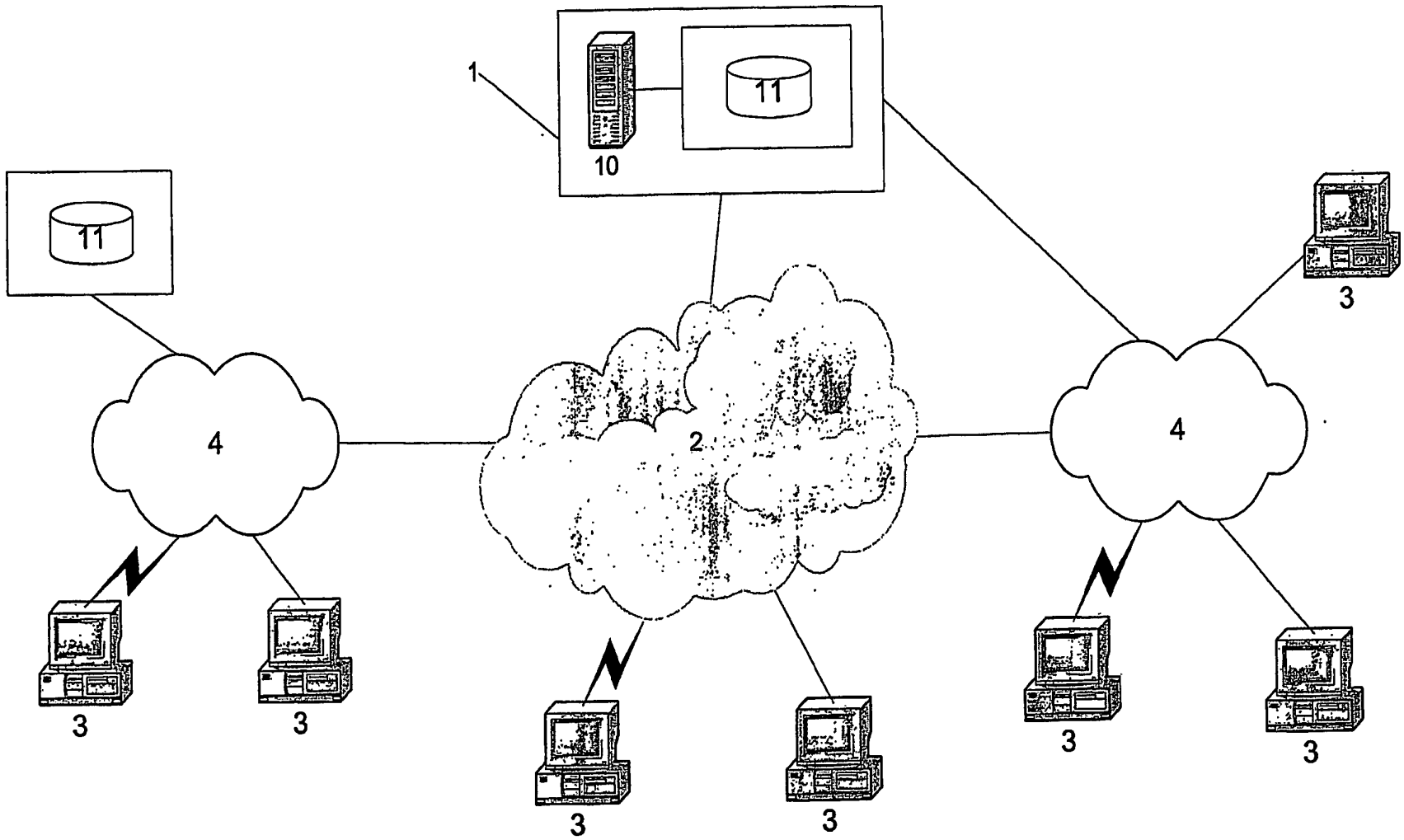


Fig. 4

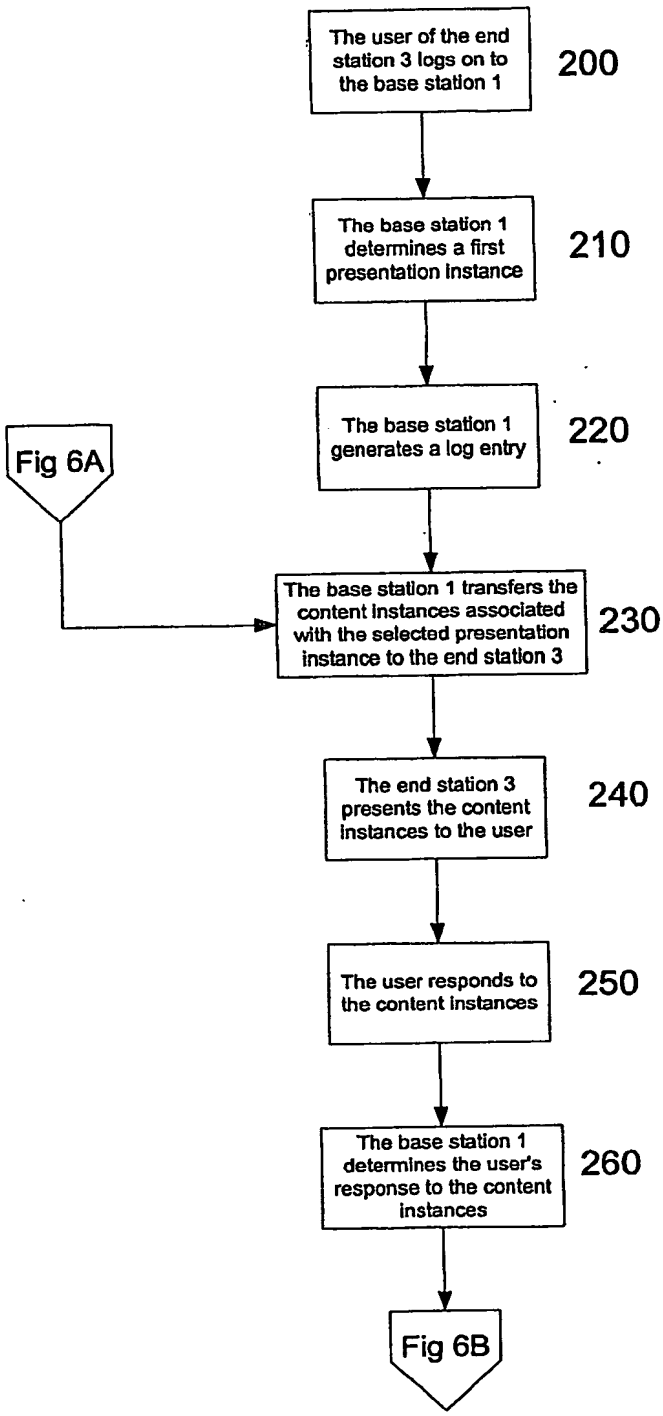

The user of the end station 3 logs on to the base station 1
200
The base station 1 determines a first presentation instance
210
The base station 1 generates a log entry
220
Fig 6A
The base station 1 transfers the content instances associated with the selected presentation instance to the end station 3
230
The end station 3 presents the content instances to the user
240
The user responds to the content instances
250
The base station 1 determines the user's response to the content instances
260
Fig 6B

Fig. 6A

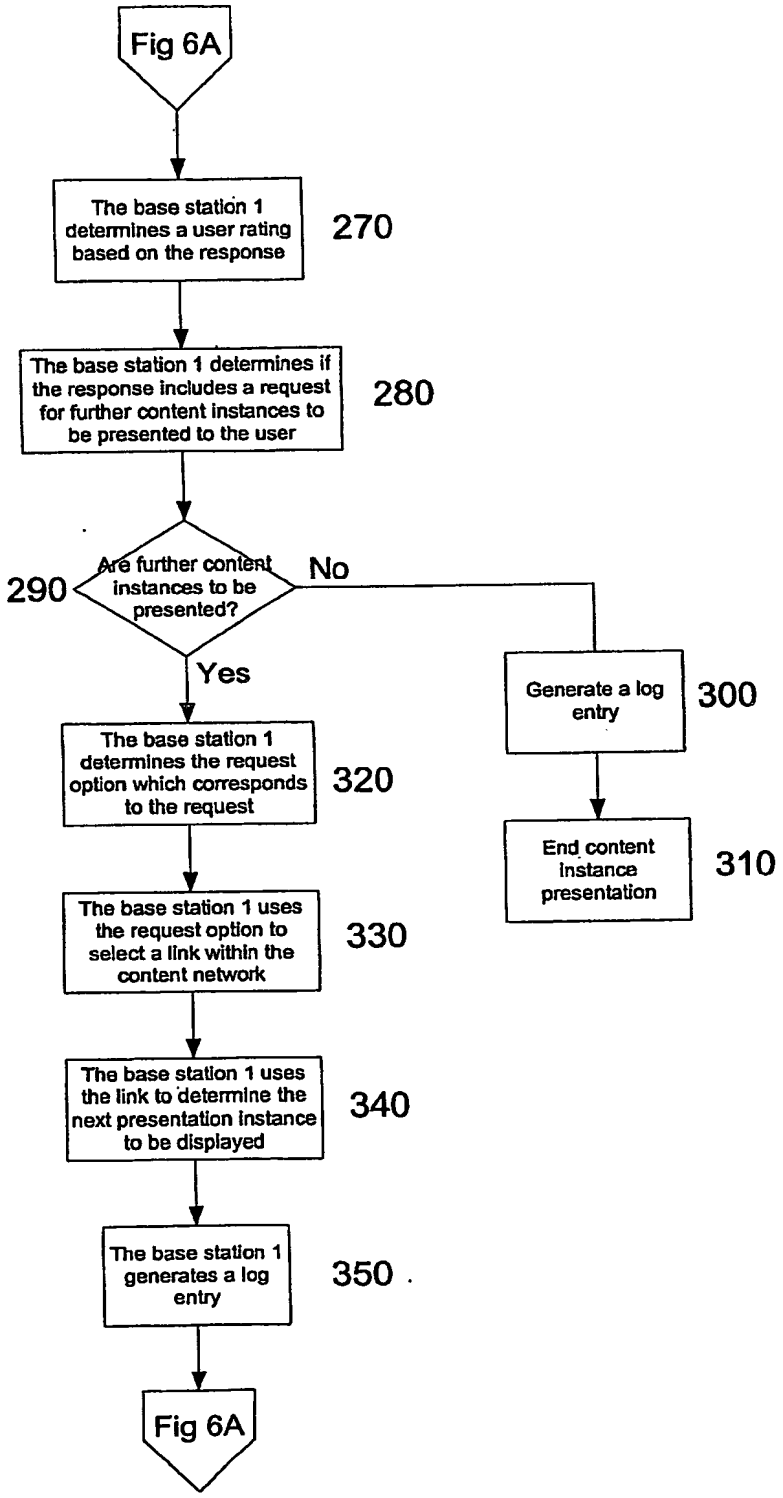


Fig 6A
The base station 1 determines a user rating based on the response
270
The base station 1 determines if the response includes a request for further content instances to be presented to the user
280
290
Are further content instances to be presented?
No
Yes
Generate a log entry
300
End content instance presentation
310
The base station 1 determines the request option which corresponds to the request
320
The base station 1 uses the request option to select a link within the content network
330
The base station 1 uses the link to determine the next presentation instance to be displayed
340
The base station 1 generates a log entry
350
Fig 6A

Fig. 6B

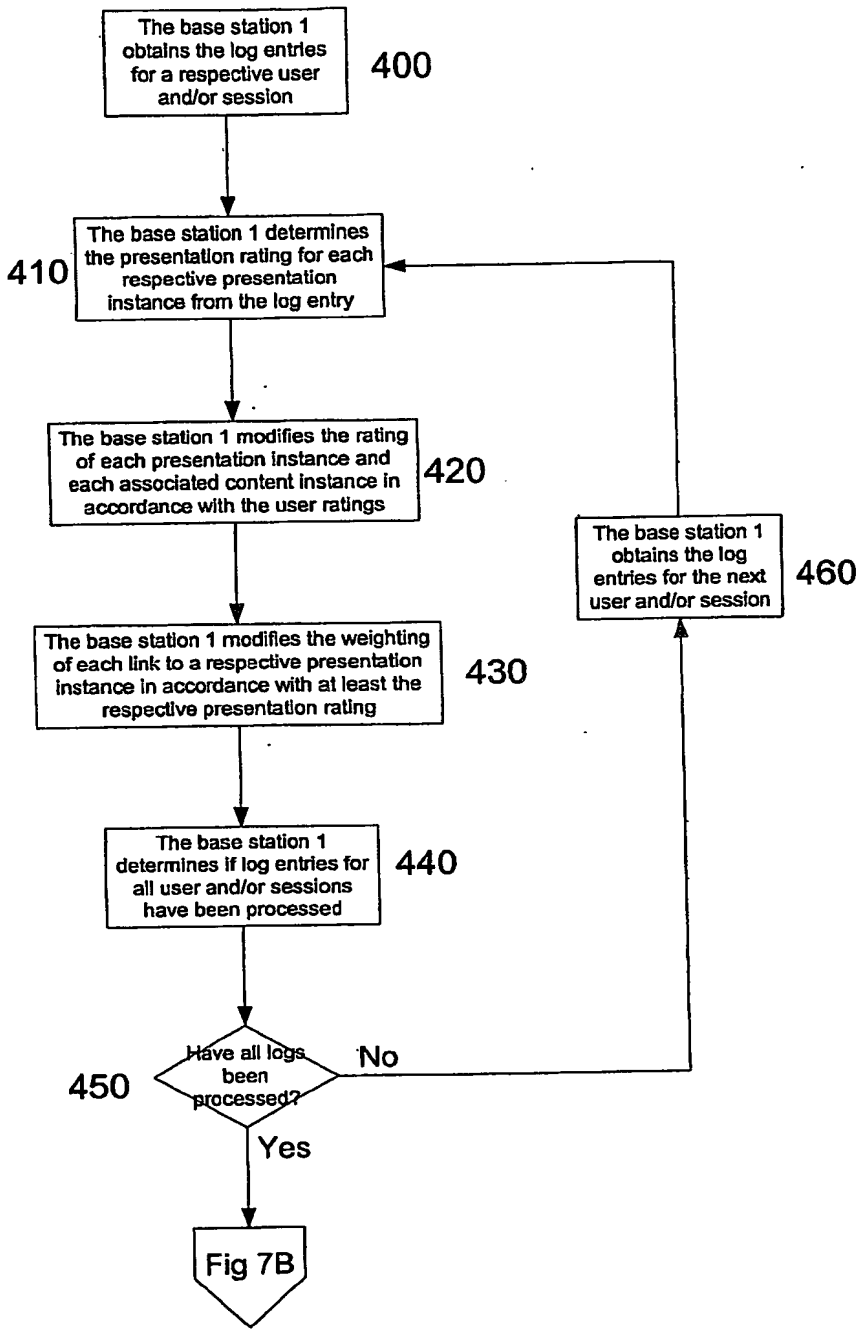

The base station 1 obtains the log entries for a respective user and/or session
400
The base station 1 determines the presentation rating for each respective presentation instance from the log entry
410
The base station 1 modifies the rating of each presentation instance and each associated content instance in accordance with the user ratings
420
The base station 1 modifies the weighting of each link to a respective presentation instance in accordance with at least the respective presentation rating
430
The base station 1 determines if log entries for all user and/or sessions have been processed
440
Have all logs been processed?
450
No
Yes
The base station 1 obtains the log entries for the next user and/or session
460
Fig 7B

Fig. 7A

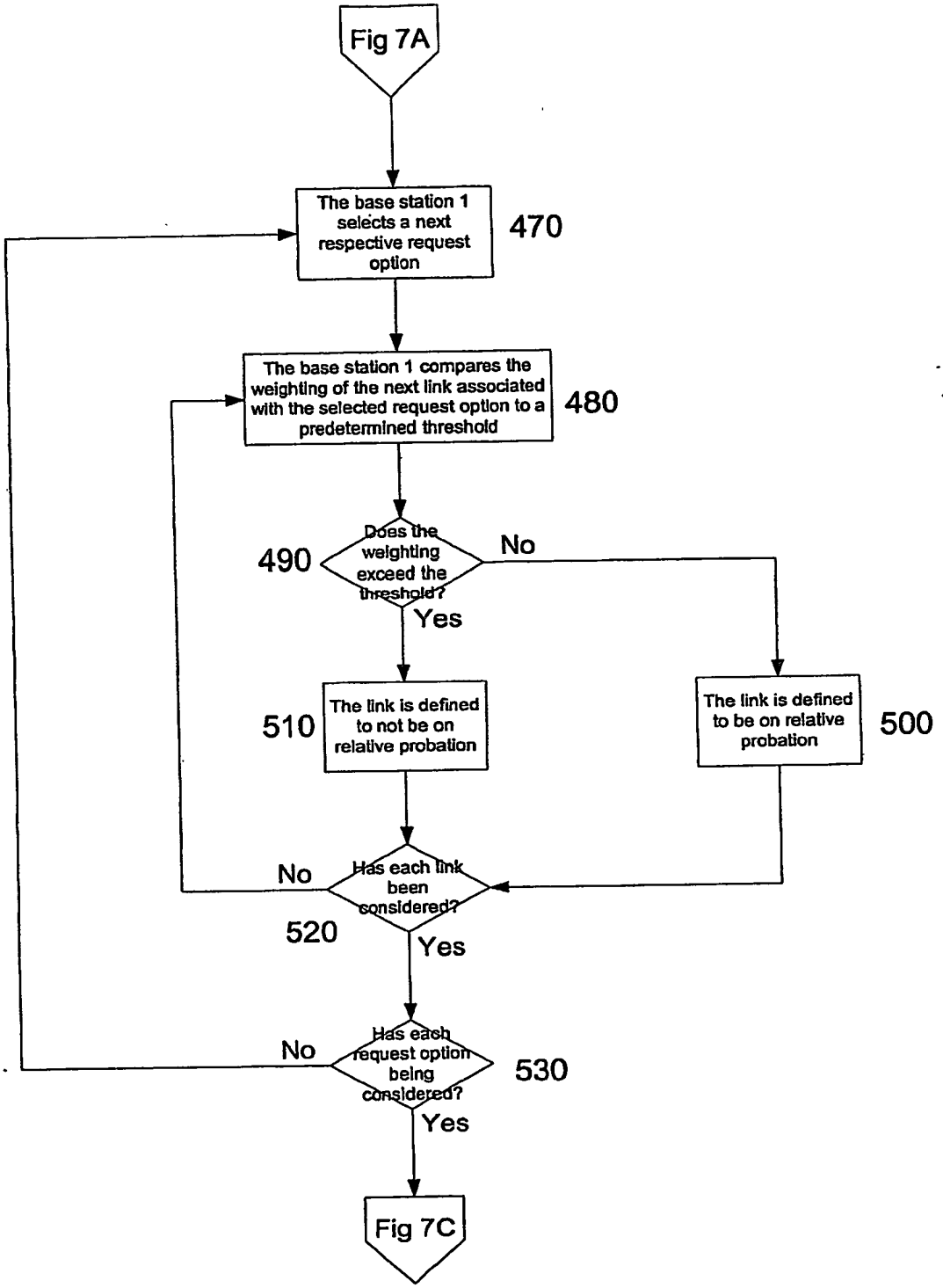


Fig 7A
The base station 1 selects a next respective request option
470
The base station 1 compares the weighting of the next link associated with the selected request option to a predetermined threshold
480
490
Does the weighting exceed the threshold?
No
Yes
510
The link is defined to not be on relative probation
The link is defined to be on relative probation
500
No
Has each link been considered?
520
Yes
No
Has each request option being considered?
530
Yes
Fig 7C

Fig. 7B

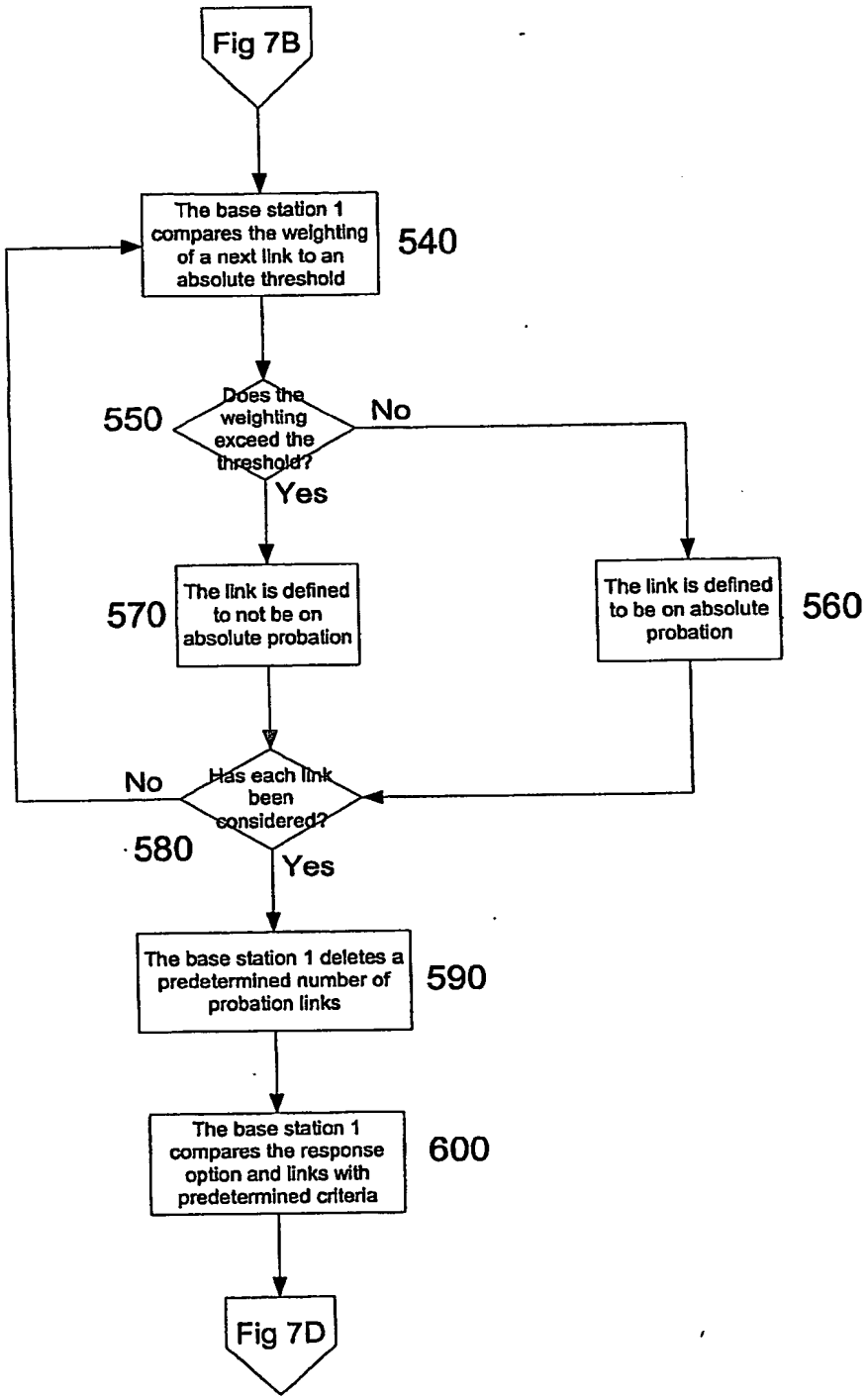


Fig 7B
The base station 1 compares the weighting of a next link to an absolute threshold
540
Does the weighting exceed the threshold?
550
No
Yes
The link is defined to not be on absolute probation
570
The link is defined to be on absolute probation
560
Has each link been considered?
No
580
Yes
The base station 1 deletes a predetermined number of probation links
590
The base station 1 compares the response option and links with predetermined criteria
600
Fig 7D

Fig. 7C

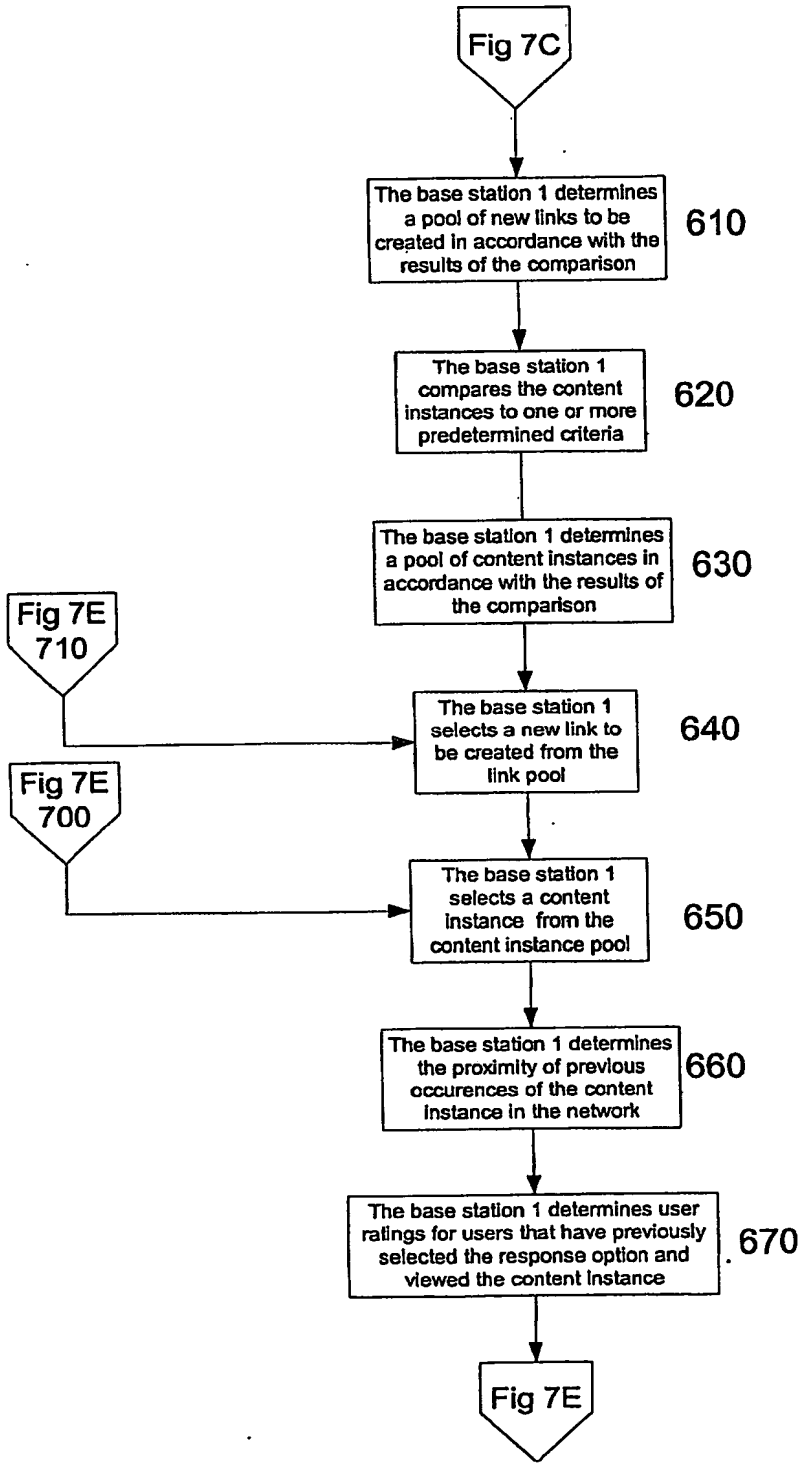


Fig 7C
The base station 1 determines a pool of new links to be created in accordance with the results of the comparison
610
The base station 1 compares the content instances to one or more predetermined criteria
620
The base station 1 determines a pool of content instances in accordance with the results of the comparison
630
Fig 7E 710
Fig 7E 700
The base station 1 selects a new link to be created from the link pool
640
The base station 1 selects a content instance from the content instance pool
650
The base station 1 determines the proximity of previous occurences of the content instance in the network
660
The base station 1 determines user ratings for users that have previously selected the response option and viewed the content instance
670
Fig 7E

Fig. 7D

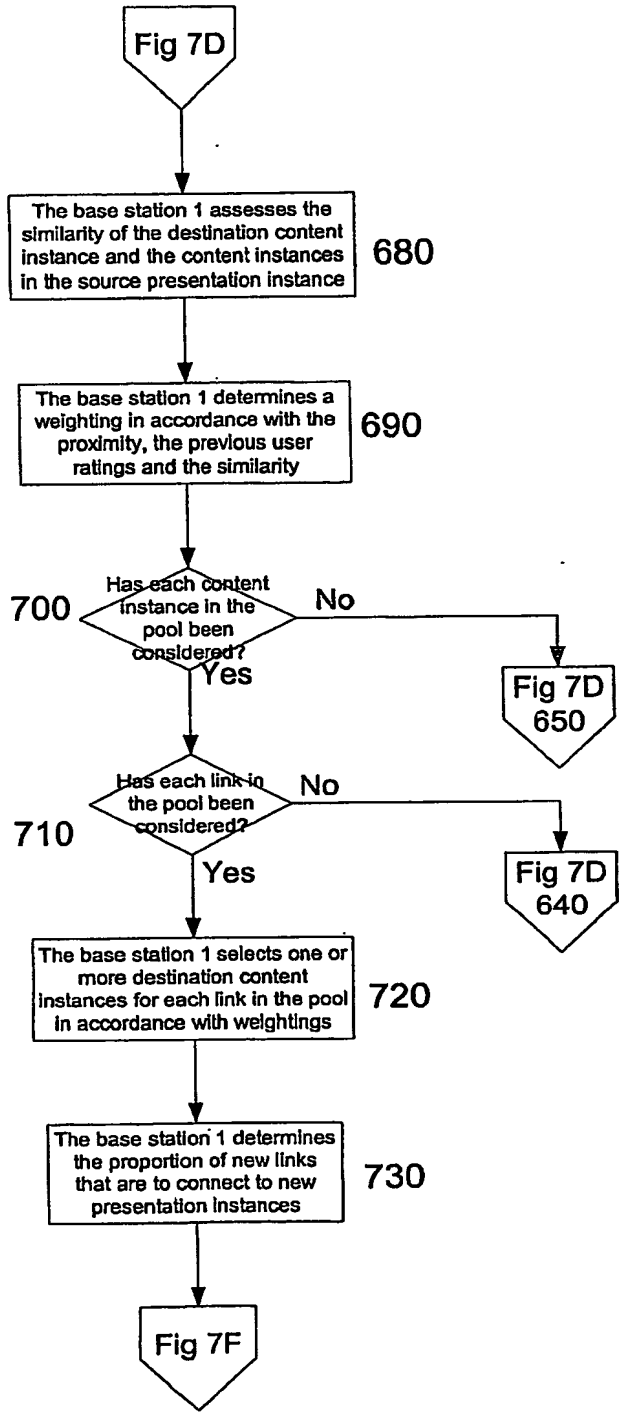


Fig 7D
The base station 1 assesses the similarity of the destination content instance and the content instances in the source presentation instance
680
The base station 1 determines a weighting in accordance with the proximity, the previous user ratings and the similarity
690
700
Has each content instance in the pool been considered?
No
Yes
Fig 7D 650
710
Has each link in the pool been considered?
No
Yes
Fig 7D 640
The base station 1 selects one or more destination content instances for each link in the pool in accordance with weightings
720
The base station 1 determines the proportion of new links that are to connect to new presentation instances
730
Fig 7F

Fig. 7E

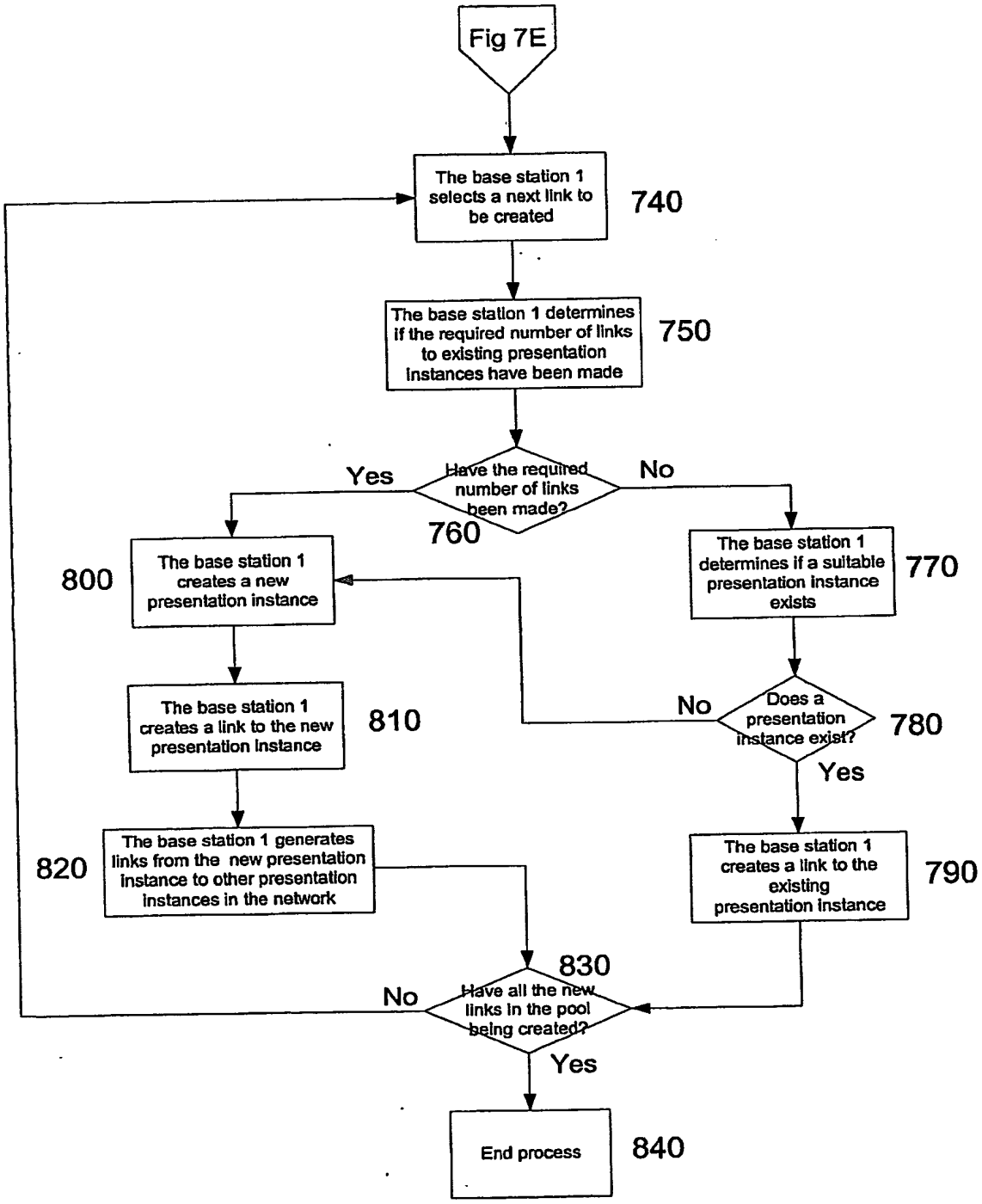


Fig 7E
The base station 1 selects a next link to be created
740
The base station 1 determines if the required number of links to existing presentation instances have been made
750
Have the required number of links been made?
760
Yes
No
The base station 1 creates a new presentation instance
800
The base station 1 creates a link to the new presentation instance
810
The base station 1 generates links from the new presentation instance to other presentation instances in the network
820
The base station 1 determines if a suitable presentation instance exists
770
Does a presentation instance exist?
780
No
Yes
The base station 1 creates a link to the existing presentation instance
790
Have all the new links in the pool being created?
830
No
Yes
End process
840

Fig. 7F